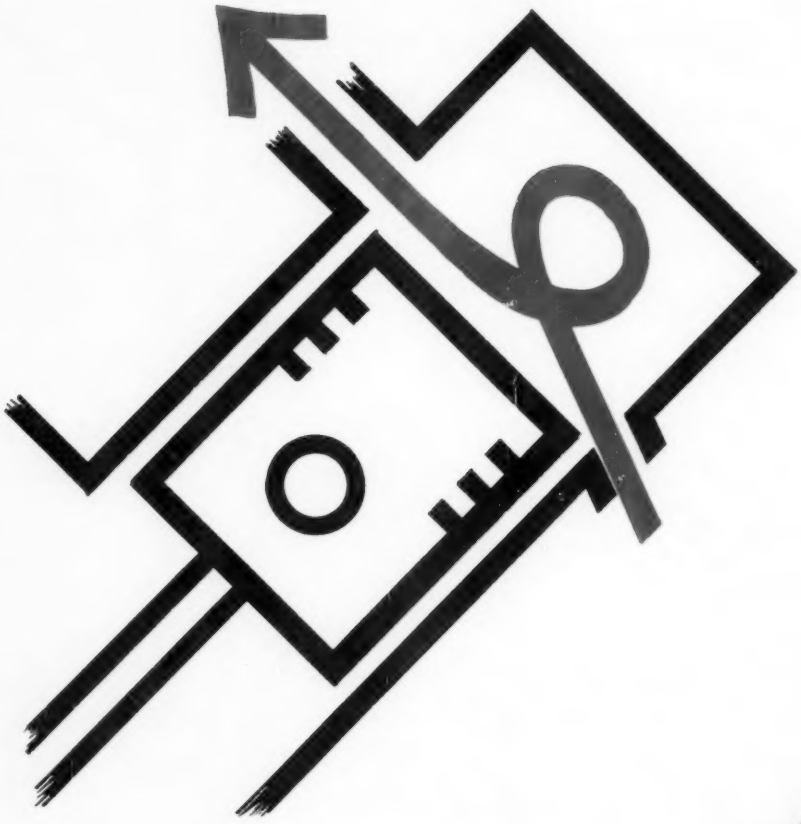
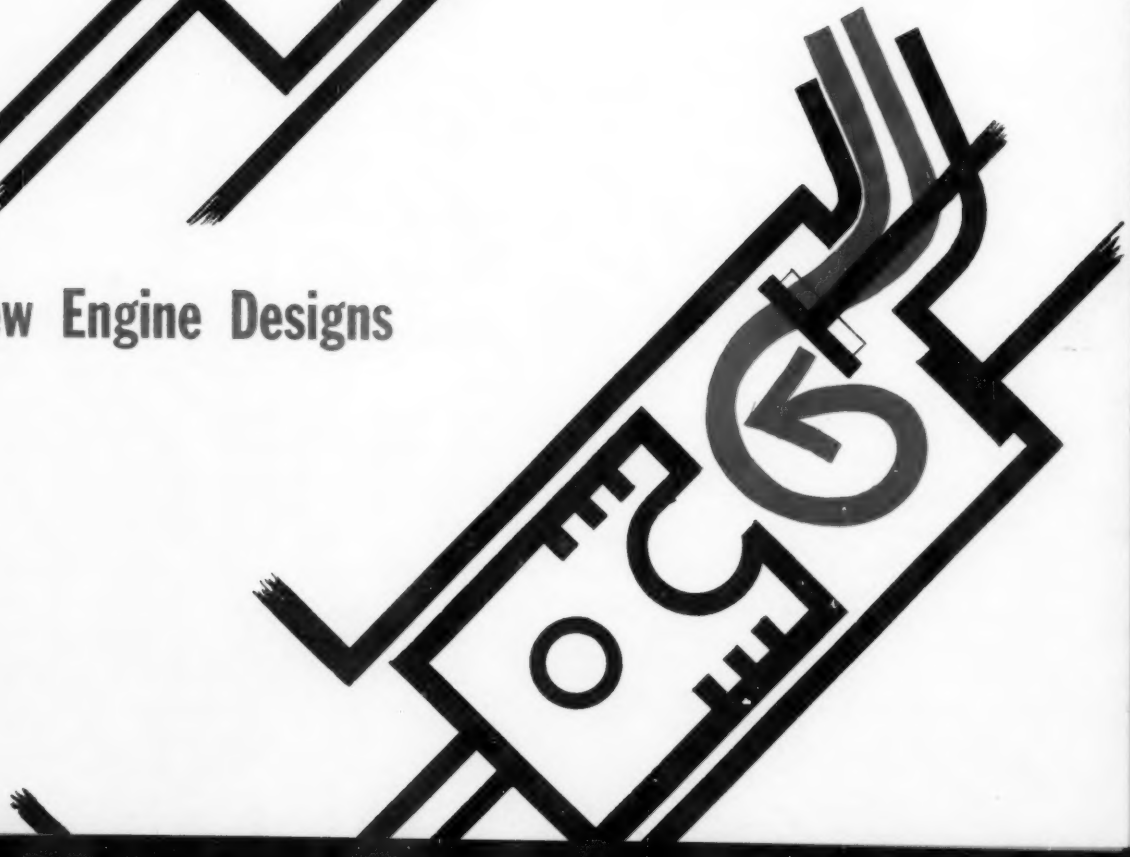
diesel power

November 1955



Two New Engine Designs



JOHN DEERE MODEL *70* DIESEL TRACTOR SETS NEW STANDARDS IN FUEL ECONOMY

The new John Deere Model "70" Diesel is a row crop tractor designed to widen the profit spread between operating costs and farm prices for farmers everywhere.

A two-cylinder tractor, the new Model "70" has practically half as many, twice as husky engine parts assuring longer, low cost service.

Contributing importantly to the outstanding engine performance of the "70" Diesel are two Bendix diesel fuel injection pumps and nozzle holder assemblies.

The choice of Bendix* Fuel Injection Equipment by John Deere for their value packed new Model "70" is another link in the long chain of evidence that, for operating economy plus durable performance, you can't beat Bendix Diesel Fuel Injection Equipment.

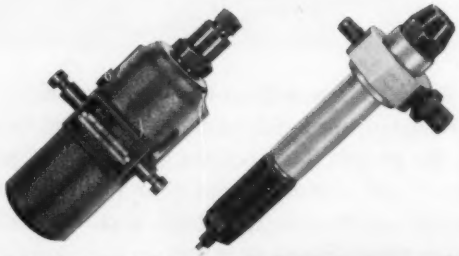
*REG. U.S. PAT. OFF.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION
SIDNEY, N. Y.

EXPORT SALES AND SERVICE: Bendix International Division
205 East 42nd St., New York 17, N. Y.

Bendix

FUEL INJECTION EQUIPMENT

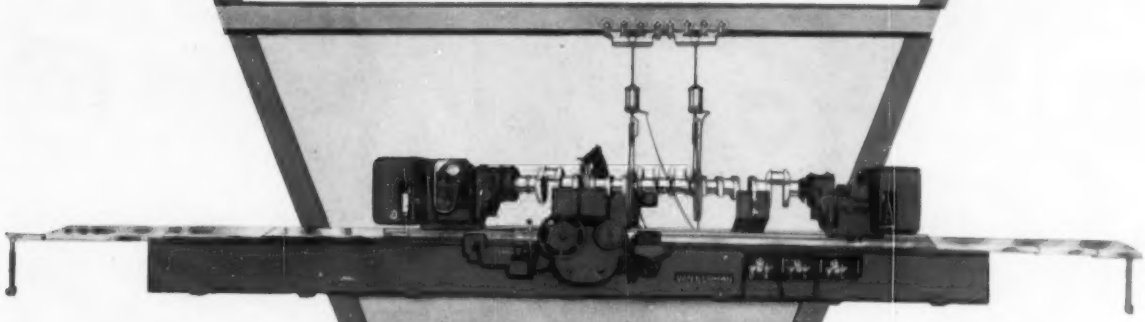


Bendix
SCINTILLA DIVISION

Bendix
AVIATION CORPORATION

The Biggest Crankshafts

are reground fast. . . right. . . without sag. . .



on the VAN NORMAN No. 111-ELW-167

Exclusive Features:

- Easier and quicker to set up and operate
- More power at point of grind
- Compensators supported by air cylinders slung from monorail trolleys
- Outboard counterbalance weights
- Unit spindle construction
- Special equipment as needed

For full details, see your VAN NORMAN JOBBER

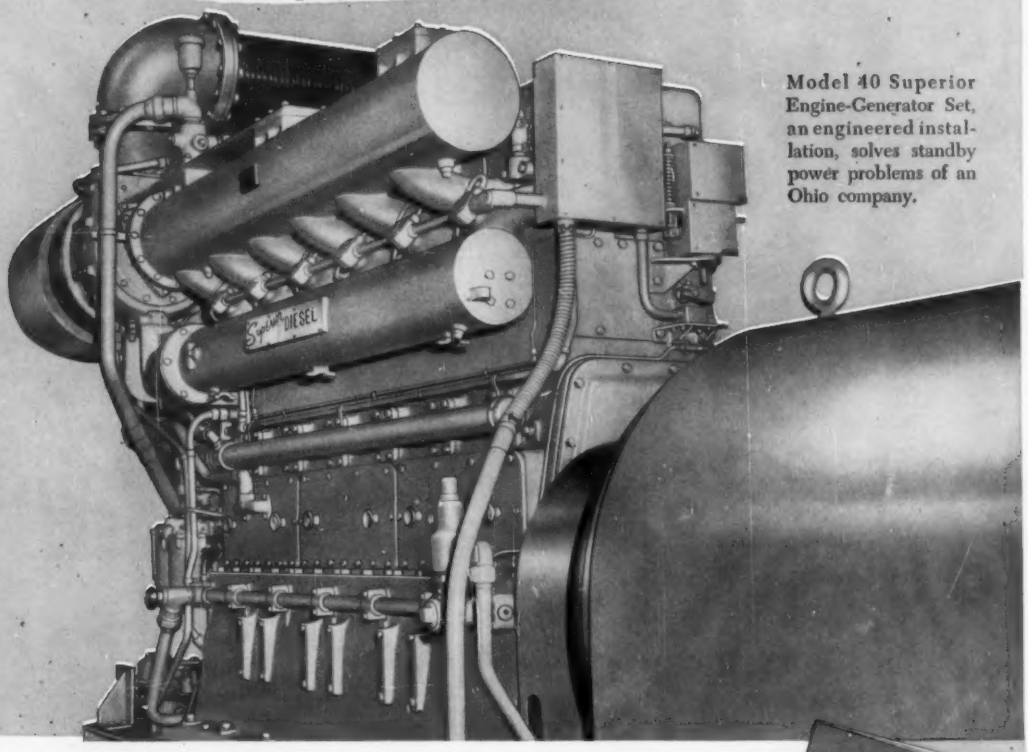
Many of these giant machines, now in operation across the country, prove that the biggest shafts can be reground to tolerances of less than .0005". What's more, the overhead compensators make it possible to grind the mains and throws of these huge shafts, and fully compensate for sag. These and many other Van Norman-engineered features are your assurance that work performed on these machines will quickly and economically duplicate the original factory finish on any crankshaft. So for the best job of crankshaft regrinding, *be sure it's done* on Van Norman machines. Van Norman Co., Springfield 7, Massachusetts.

The Best Equipped Shop is the Van Normanized Shop

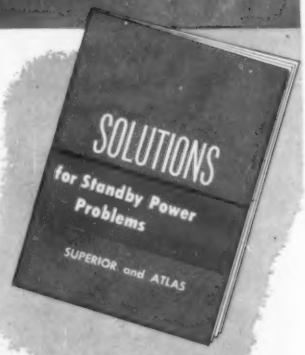
see how

Superior or Atlas Engines

solve your **standby power** problems



Model 40 Superior Engine-Generator Set, an engineered installation, solves standby power problems of an Ohio company.



Engineered installations of Superior and Atlas Diesel, dual fuel and gas engine-generator sets have solved hundreds of standby power problems! In many cases they've paid for themselves. Their automatic start and stop operation often averts tragic consequences, by providing efficient, dependable power for essential plant services in every instance of main power source failures. In order for you to have all the facts and figures we've prepared a special case history file. It shows many instances of how our skilled engineers assisted in solving serious problems involving special considerations and peculiarities in individual installations. Chances are many of the installations will be similar to yours. This information will prove a valuable aid in your planning.

Write, on your letterhead, requesting this file of helpful examples. White's skilled engineers, with years of experience in developing engineered installations of Superior or Atlas engine-generator sets, will assist you in engineering the proper standby power for your specific requirements.

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • ***Plant and General Offices: Springfield, Ohio***

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

editors notes...

You'll want to read about...

The M-Combustion system of MAN as incorporated in a vehicular engine. This system is opposed to just about all accepted ideas on the requirements for good combustion. Performance of the engine is remarkable enough for American manufacturers to be taking a good close look at it. You'll want to know about it too . . . .

Something to watch out for whenever you weld. Unless you do as advised, it is possible that you'll ruin expensive parts and may never know the reason. If you use welding in any of your maintenance work, read this one . . . .

How the USAF employs diesel reliability to insure continuous power for round-the-world communications—lifeblood of the Strategic Air Command and the whole USAF . . . .

Factors that affect lube oil life and filter change periods. Here's a real switch in thinking and a particularly practical approach to extending lube oil and filter life. You'll want to read the comments about the effect of engine fuels . . . .

The possibility of controlling output shaft speeds with a fluid coupling. This is an added feature of the unit that offers all the advantages of fluid coupling drive as well . . . .

Another new engine design. If you think that the only answer to high output for a given size and weight of engine is high bmep's, here's news for you. White Motor's V-106 engine uses the space and weight saved by getting rid of valve gear through loop-scavenging to give more displacement . . . .

diesel power

Established in 1923 Vol. 33, No. 11 November, 1955

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Getting More From Less 35

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Baldwins for USAF Communications System 44

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Diesel Publications, Inc., 192 Lexington Avenue, New York 16, N. Y.

Cable Address: Dieselpub — New York

see how

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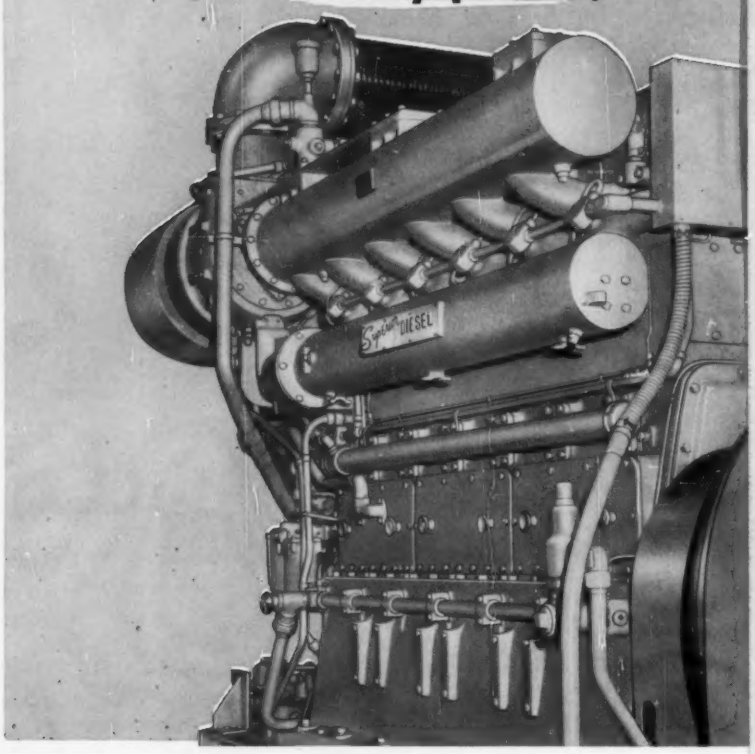
solve your **standby power** problems



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WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • ***Plant and General Offices: Springfield, Ohio***

You'll want to read about...

A diesel-hydraulic switcher for the Transportation Corps. The Maybach hydraulic transmission mechanism used is similar to that which, with a Maybach engine, will power B-L-H's lightweight high-speed locomotive. We'll have this story later . . . .

Field repairs on American Bosch PSB fuel injection pumps. There is a definite limit to the repairs that are practical with this equipment, so it is important that you know what and what not to do. This knowledge may save you a repair bill and downtime . . . .

More turbocharged engines by Cummins. Encouraging reports on the performance of these and other turbocharged high-speed diesels lead us to believe that normal aspiration will soon be the exception rather than the rule for a good many applications and engine sizes . . . .

The features are all tailored to your needs. The "Tool Box" is back this month. Our reminder to get your items in brought some, but we still can use more.

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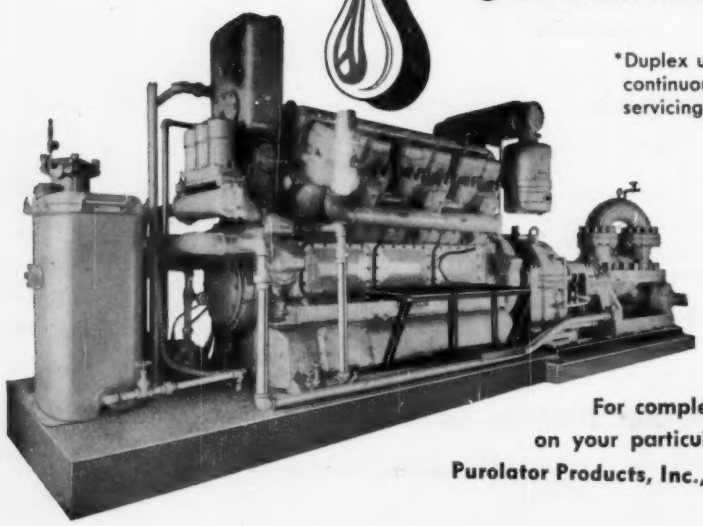
For positive filter protection . . .

CHECK THESE 5 POINTS WITH PUROLATOR

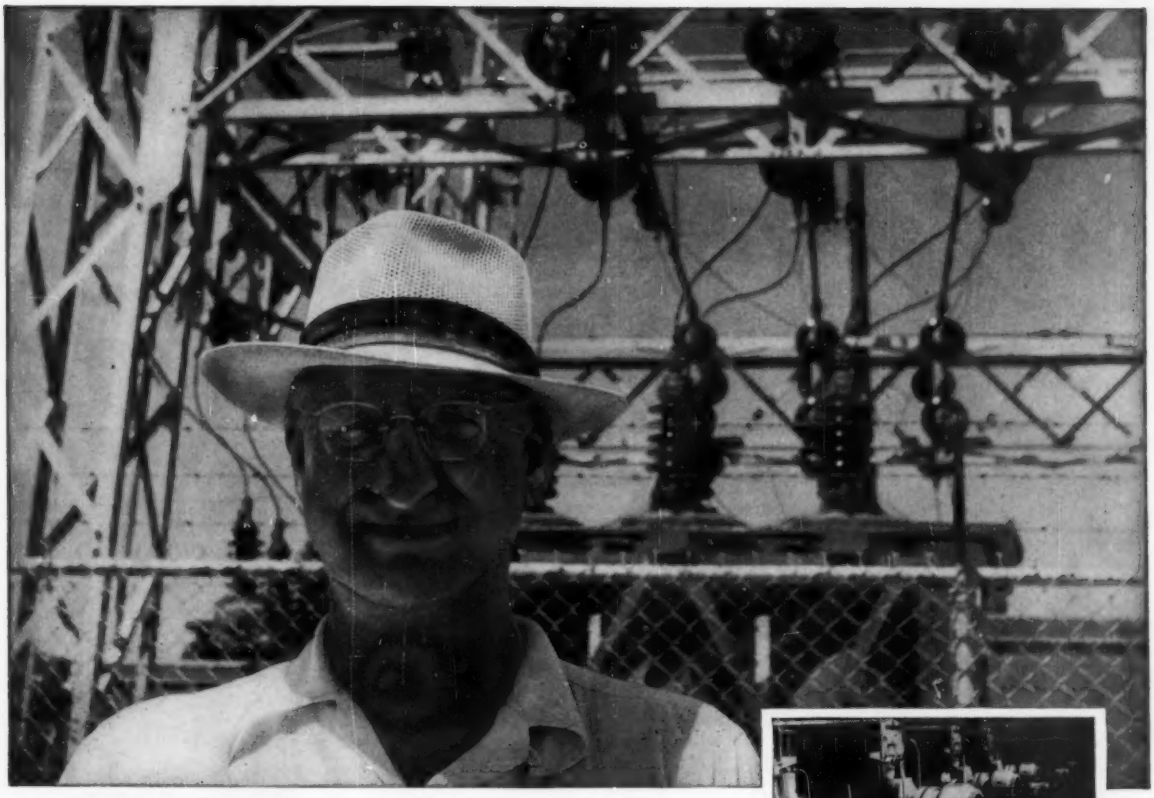
"FIRST in the field of filtering"

- **Full flow lubricant filtration**
- **Micronic filtration of fuel to the injector pump ***
- **Individual filter protection for each nozzle**
- **Metal edge filter to protect fuel transfer pump ***
- **Air intake filtration**

*Duplex units available for continuous operation while servicing filter elements.



For complete technical filter data on your particular diesel application, write to Purolator Products, Inc., Dept. DL1-1111, Rahway, New Jersey.



POWERFUL GUY!

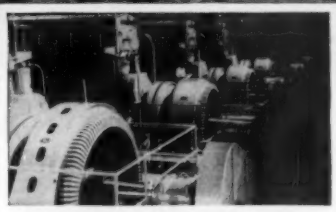
His four Nordberg Diesels, lubricated by Cities Service DC-940 Oil, supply six Oklahoma Counties with REA power. Have one of lowest cost-per-KWH records of entire REA.

His name's H. P. Wingo, and he's Chief Engineer of the REA plant operated by Western Farmers Electric Cooperative.

For the past four years, since his plant began operation in Woodward, Oklahoma, he's been responsible for a consistently high power efficiency rating, measured in cost per kilowatt hour...as high as fifth among all 42 REA plants! To maintain this record, he's had important help... help from four 1100 KW Nordberg dual-fuel engines...and help from Cities Service DC-940 Oil.

"Our engine compressions are the same today as they were after the first three months' operation," says Wingo. "In addition, using Cities Service DC-940, rings have remained absolutely free, liners have worn less than .0015, and we average 14,000 horsepower hours per gallon of oil. Filter elements last up to 1,500 hours."

Wingo has added his words of praise to those of scores of other users of Cities Service Lubricants. Summed up, these reports clearly demonstrate that superior performance is not the exception, but the rule, with Cities Service products. Your Cities Service Lubrication Engineer can readily explain why. Talk it over with him. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

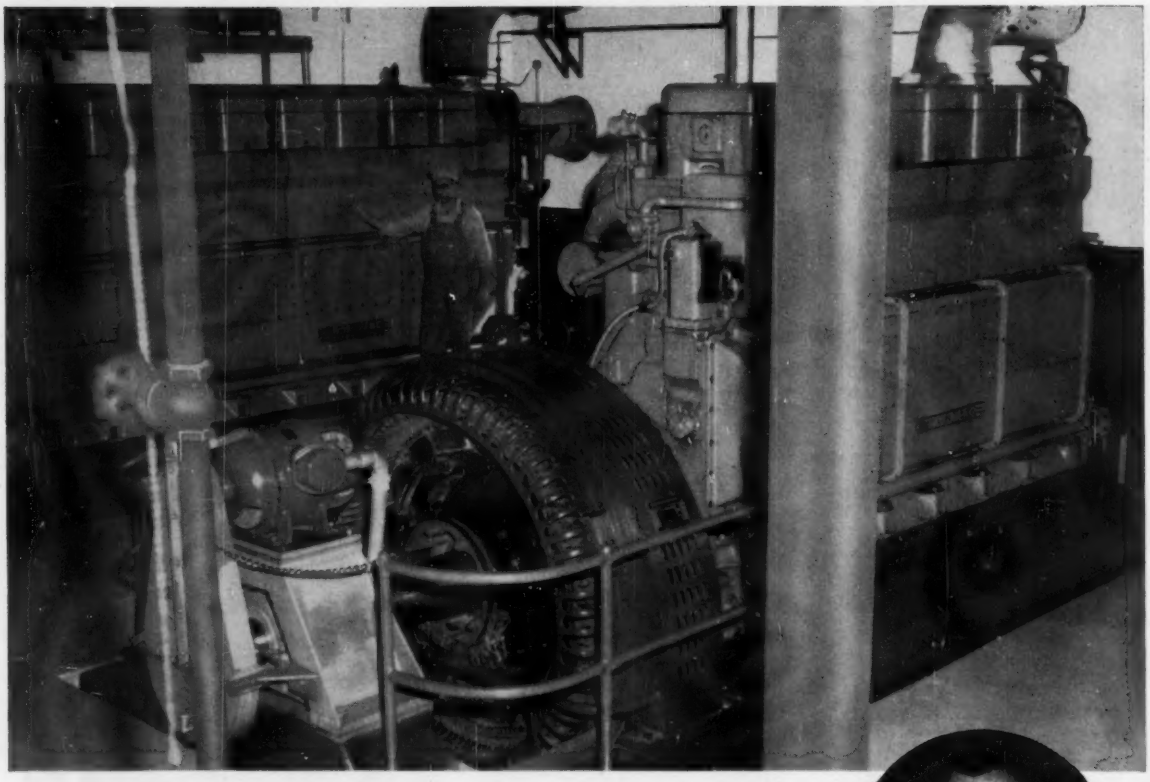


4 NORDBERGS, 4 YEARS OLD... yet engine compression remains the same as after first three months of operation at Western Electric REA Plant, Woodward, Okla. Rings "absolutely free," liners worn less than .0015, oil consumption at 14,000 H.P. hrs. per gallon using Cities Service DC-940 Oil.

CLOSE CHECK is kept on entire operation. Meanwhile, Cities Service Lubrication checks wear in Nordberg engines, helps engineer Wingo maintain record of low cost electricity. Supplying economical power to six Oklahoma Counties, plant's power efficiency rating has been as high as 5th in entire REA.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



KINGFISHER, OKLAHOMA . . .

Another Municipality Profits by Installing NORDBERG Duafuel® Engines

● The growth pattern of the progressive City of Kingfisher is similar to many municipalities operating city-owned utilities. Starting at the turn of the century with a 125 kw steam engine operating for night lighting, the plant was expanded with steam engine and turbine power until a capacity of 1750 kw was reached in 1954.

To improve service and increase the efficiency and economy of the plant, the city then installed two new Nordberg Duafuel engines—a 1420 hp, 1000 kw, *Supairthermal®* unit, and an 847 hp, 600 kw, supercharged unit, both operating at 450 rpm. Now this modern plant has a total capacity of 2600 kw . . . 1600 kw from the Duafuel engines, and 1000 kw from a steam turbine.

Since the two Nordberg engines were installed, they have carried the full plant load, with no down time, and with substantial savings in operating costs. During the last half of 1954 over 3,000,000 kwh were generated at a cost of 6.4 mills per kwh—as compared to a cost of 9.5 mills per kwh which would have been required by the steam turbine—further proof of the economy and dependability of Nordberg power.

NORDBERG MFG. CO., Milwaukee, Wisconsin

Mr. C. A. Garrett,
Plant Superintendent,
City of Kingfisher, Oklahoma

● Here's what Mr. Garrett has to say about the two Nordberg Duafuel engines installed in the Kingfisher plant:

"We are very pleased with these engines, and in the way Nordberg has worked with us. We feel that our plant is a great asset to Kingfisher, and the Nordberg engines are giving us a very nice saving in operating cost over steam . . . in fact, they pay for almost all of the cost of running the city."

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

© 1955, Nordberg Mfg. Co.

BUILDERS OF AMERICA'S LARGEST HEAVY DUTY ENGINE LINE . . . 10 to over 12,000 HORSEPOWER

P555

WOODWARD

GOVERNOR SERVICE

SUITS ALL FIELD CONDITIONS

We at the Woodward Governor Company have always been ready, willing and able to give users of our equipment competent, economical and, whenever necessary, very fast service, for routine governor overhauls or for emergencies that arise on rare occasions. When speed is important we have a fleet of airplanes and several competent pilots to transport governors or service men quickly.

BUT—a lot of users of our equipment don't seem to know about this. Here's the story:

Our experienced people, using the best and most expensive special tools, test stands, and other facilities in our plant can rebuild a governor in a minimum time. They install all the latest improvements, so the rebuilt governor often works better or lasts longer in service than when it was new.

In most real, but fortunately rare, emergencies, we can do the job in one day, though ordinary jobs require more time because our shop is very busy.

The cost, labor plus regular list price for parts, depends on how clean the governor has been kept, its age, engine roughness, and other factors.

Here are four ways to have your governor put in new condition, with a new governor guarantee on work done in our plant:

1. REPAIR AND RETURN

While your engine or turbine is shut down for other work, return the governor to our factory in Rockford, Illinois. No return tags needed, no formalities—just make sure your company name is on the crate. It helps too, if your purchase order lists the governor serial number. Some governors of which only one or a few were built can only be handled this way. In most cases the unit exchange plan below is better and the cost is the same.

2. UNIT EXCHANGE

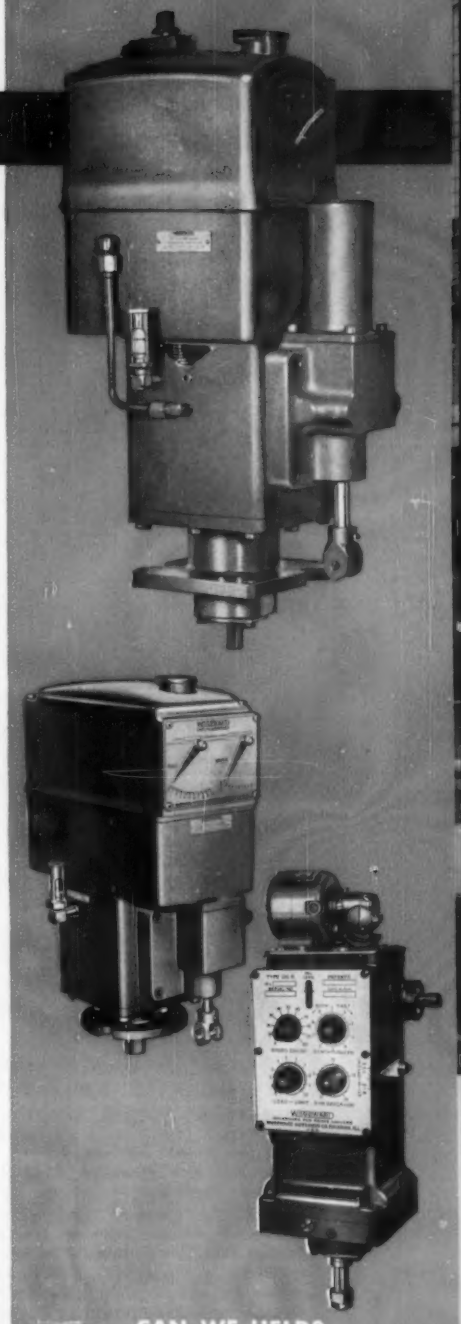
Send us a purchase order with the serial number of your governor, and tell us when you plan to shut down to install it. We'll ship a governor like yours but with all the latest improvements. It takes only a few minutes to remove the old one and install the replacement. Send the old governor back to us for overhaul, and we'll keep it in our stock ready for the next plant that needs it. Try to order early when possible, and we'll try always to give same day service IF there's a real emergency. The cost? Same time and material as above. You pay shipping costs.

3. OVERHAUL OR REPAIR IN YOUR PLANT

This is the most expensive and least satisfactory way to overhaul a governor, but if an emergency or special circumstances make it desirable, we'll send a man to your plant.

4. DO IT YOURSELF

Some competent mechanics repair their own governors in the field, though there usually isn't much saving in doing so. Give us the serial number of the governor and we'll send bulletins and suggest parts you may need. If you have a lot of governors, send your repair man to our plant for two to four days training. If you're having some little trouble, write us about it and maybe we can tell you the cause. HALF THE GOVERNOR TROUBLES AREN'T IN THE GOVERNOR—AND MOST OF THE OTHERS COME FROM DIRT. Washing the governor in spirits once a year and filling with clean oil helps prevent trouble. You can easily replace your own oil seals every few years.



CAN WE HELP?
WANT INSTRUCTION BULLETINS?

Tell us the serial number of the governor (or typical governors) and what it's controlling (AC generating unit, boiler feed water pump turbine, cat-cracker air blower, etc.). We'll answer promptly.

WOODWARD GOVERNOR COMPANY
Rockford, Illinois

WOODWARD SERVICE

WORLD'S OLDEST AND LARGEST MANUFACTURER OF HYDRAULIC GOVERNORS FOR PRIME MOVERS

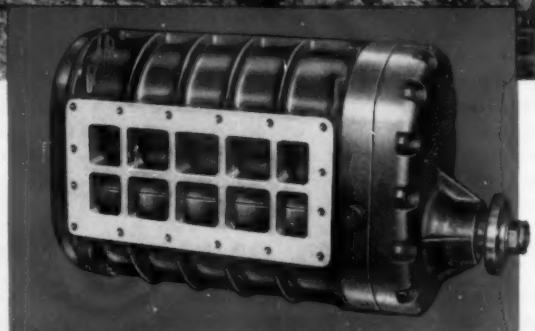
GIANT HD-21 CRAWLER DOZES with Supercharged Power!

ALLIS-CHALMERS STANDARDIZES ON MIEHLE-DEXTER SUPERCHARGERS FOR THEIR DIESEL ENGINES

Like so many leading Diesel engine manufacturers, Allis-Chalmers specifies Miehle-Dexter Superchargers for their engines.

And that's one of the reasons this new giant torque converter driven crawler tractor—the Allis-Chalmers Model HD-21—claims to be one of the most powerful crawlers . . . anywhere! Rough and rugged dozing needs power aplenty. And here's *extra* speed at any load, *extra* pushing or pulling power at any speed, wider speed range and more range overlap—thanks to Miehle-Dexter Supercharged Power.

You, too, can boost the horsepower of your engines by 50% or more . . . and decrease weight per horsepower, too. Miehle-Dexter engineers can specify the exact size and type M-D supercharger for your engines. Standard M-D models available for applications to 750 hp. Write for bulletin.



FOUR FEATURES PROVE MIEHLE-DEXTER SUPERCHARGERS BETTER ON THE JOB

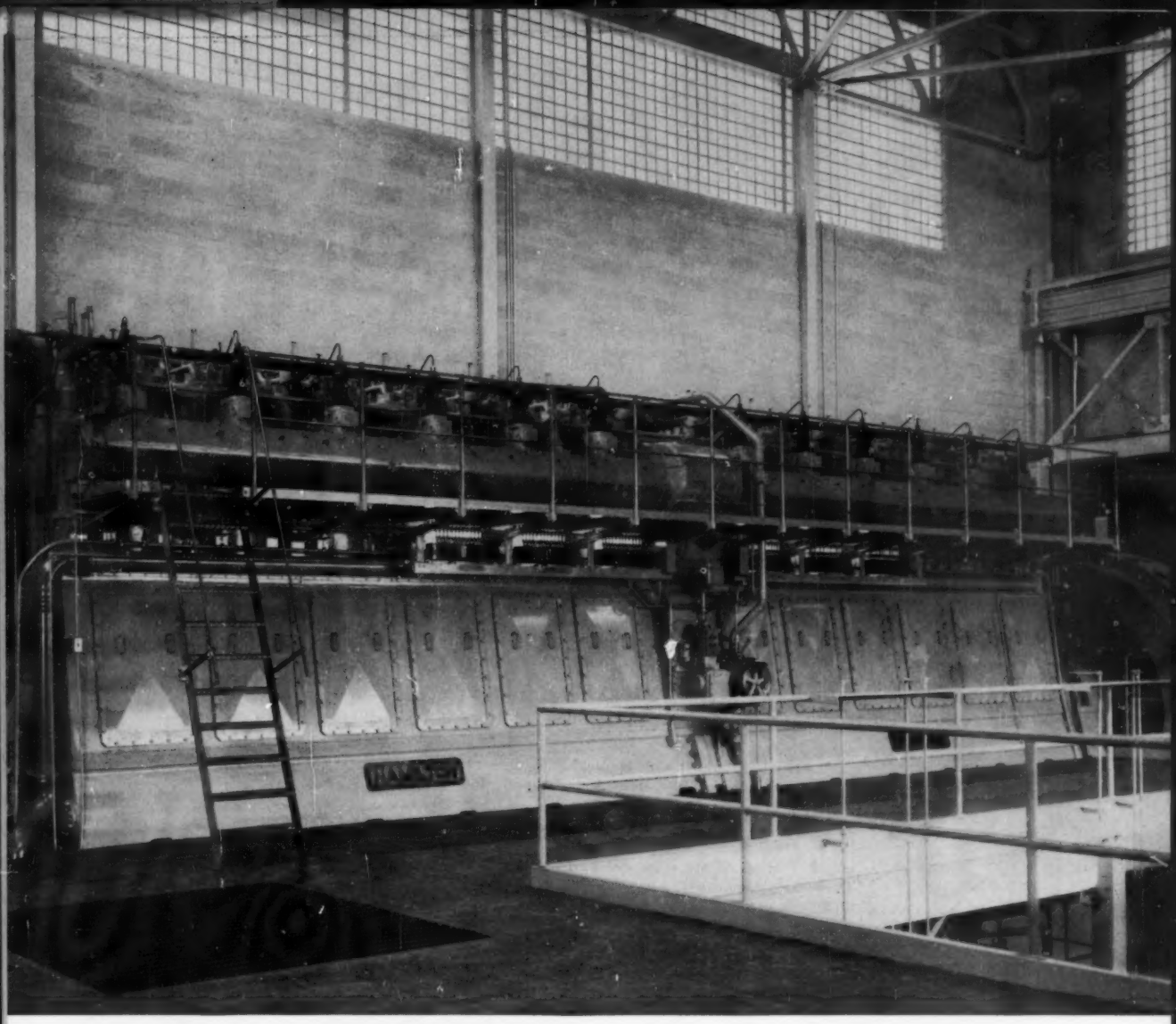
- Patented end plate seals eliminate metal-to-metal contact, assure longer life, help achieve fuel savings.
- Rotor wear strips eliminate contact between rotors and housing, assure longer wear.
- Lightweight aluminum rotors and aluminum case boost engine horsepower, do not add weight, safely allow high speeds.
- All parts are standardized, allowing easy field service and interchangeability.

NOW ON TEST . . .
AN ENTIRELY *NEW* TYPE
OF *TURBOCHARGER!*

MIEHLE-DEXTER SUPERCHARGER

Division of the Dexter Folder Company

100 Fourth Street • Racine, Wisconsin



L. C. Pettibone, Supt., Electric Light & Power Dept., Decatur, Indiana, reports:

"Our Hamilton diesel burns heaviest residuals with invisible exhaust...for just 4.6 mills per kwh"

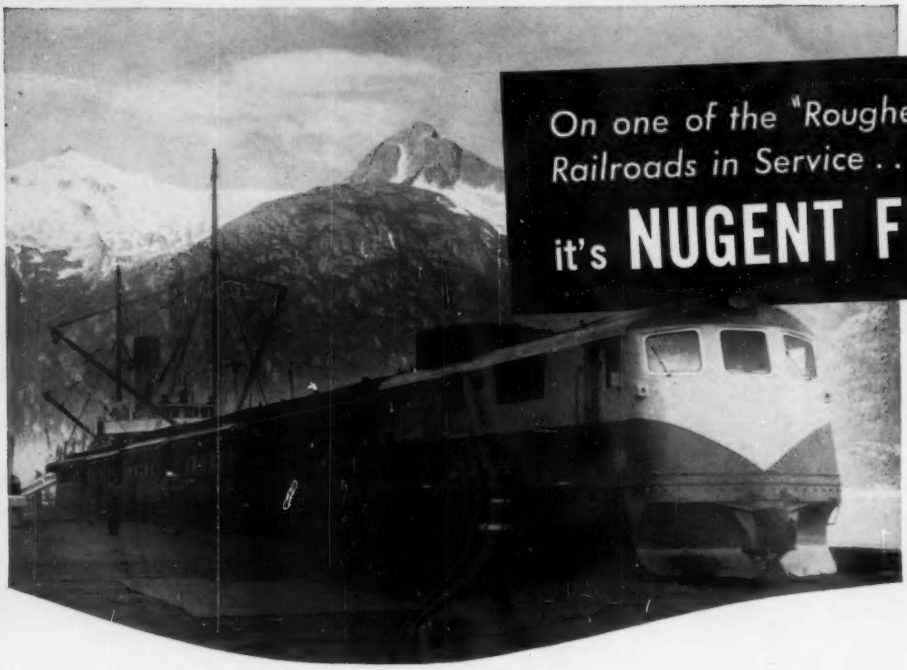
"This 3810 kw Hamilton 21½ x 27½ engine is operating 18 to 20 hours per day, burning very heavy fuel (no. 6) *with an absolutely invisible exhaust.* We have experienced *no unusual piston ring or liner wear.*

"This engine provides for the turbulence at time of fuel injection and considerably more air in the cylinder. That is why we can burn the very heaviest fuels on the market today . . . for just 4.6 mills per kwh.

"We extend a cordial invitation to any Diesel engine operators to visit our Decatur plant and see our complete fuel handling system and this Diesel generating unit," Mr. Pettibone concludes.

Hamilton Division, Hamilton, Ohio

BALDWIN-LIMA-HAMILTON



On one of the "Roughest Going" Railroads in Service . . . it's NUGENT FILTERS

Nugent Fig. 1280GW Duplex Fuel Filter.

Nugent Fig. 1280CP, IR and IS Pressure Fuel Filter.

• **Actually rough going is putting it mildly.**

Temperatures of 90° in summer to 65° below zero in winter! Blinding blizzards that build snowdrifts up to 20 feet in some areas, and winds that fill a locomotive cab full of snow in minutes . . . the kind of weather that causes trouble with ice and wax in the fuel oil. 111 miles of steep grades and sharp, *15 to 20 degree curves!* These are the unbelievable conditions under which the White Pass & Yukon diesel locomotives must operate. This gives a pretty clear picture of why top-flight, dependable equipment is a must. Every mechanical element must do a job. *And do it well!* That's why Nugent filters were selected for filtering requirements on both 800 H.P. diesel engines.

Regardless of weather or the strain of "open throttle" operation, the Nugent filters do their part of the job well. The Nugent filters continuously filter out dirt particles as small as a few microns and prevent them from entering the engine's fuel system where they might cause wear of injection-pump plungers and fuel nozzles. The lube oil strainer gives full flow protection of lubrication to the engine bearings without frequent servicing of the strainer because of large dirt holding capacity of the strainer basket.

This is another example of a leading company recognizing the long range effectiveness of Nugent filters . . . and why it is *the first choice* on so many diesel engines. *It will pay you to follow this example.* Whatever your filtering requirements—fuel, lube oil or coolants—there's always an economical Nugent filter available of proper size and type. Write for full details on how Nugent filters can improve the efficiency of your operations.

Nugent Fig. 1554AL #4L Lubricationg Oil Strainer.

Wm. W. Nugent & Co., Inc.

417 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

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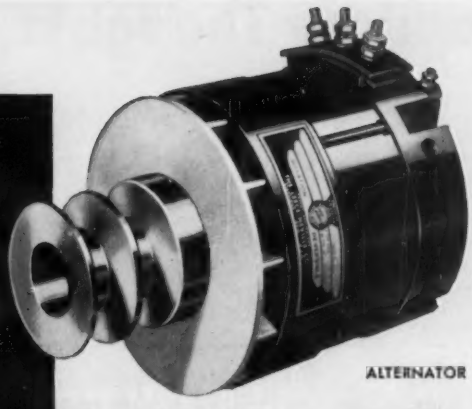
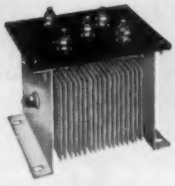
Established 1897

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS 75th ANNIVERSARY 1880-1955

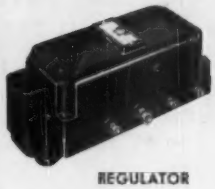
Leece-Neville



ALTERNATOR



RECTIFIER



REGULATOR

New AC-DC ALTERNATOR SYSTEM DELIVERS *125* Amps

Weighs only 44 lbs. Costs much less than comparable d.c. system

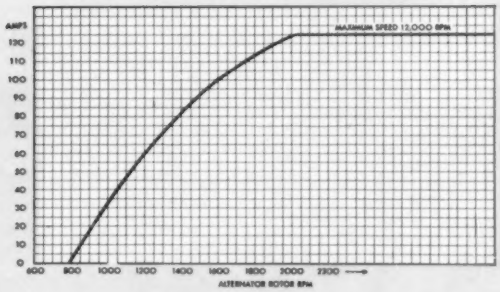
At the price you formerly paid for a 100 ampere L-N Alternator System, you now get 125 amperes . . . and at a cost far below that of a d.c. generator.

Built on a 6⅜ inch diameter frame, the Alternator weighs only 27 lbs. Rectifier and Regulator bring the total weight of the generating system to only 44 lbs. Compare that with the weight of a d.c. generator of the same output and you'll find an important weight saving.

The performance curve shows the low cut-in speed and rapid attainment of full output. Charging current at engine idle speed will vary with drive ratio.

This new L-N Alternator System is ideally suited for many types of vehicles with 12 volt electrical systems: buses, trucks, trolley coaches, school buses, fire trucks, mine and construction equipment. For applications requiring a fan-cooled rectifier, an Alternator with a shaft-mounted fan at rear is available.

PERFORMANCE AT 12 VOLTS



There are L-N Alternators with capacities ranging to 95 amperes for 6 volt systems; to 180 amperes for 12-volt; to 100 amperes for 24 volt; and to 50 amperes for 32 volt. All of them have the rugged design and precision manufacture that give L-N Alternators unmatched reliability and long life. Be sure to specify Leece-Neville.

Since 1946, L-N Alternators have been helping fleet owners cut operating and maintenance costs. For all the facts, write The Leece-Neville Company, Cleveland 3, Ohio. *Distributors in principal cities . . . service stations everywhere.*

YOU CAN RELY ON Leece-Neville

Automotive Electric Equipment Since 1909

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ALTERNATOR SYSTEMS

D C GENERATORS

CRANKING MOTORS

REGULATORS

SWITCHES

SMALL MOTORS

Random Thoughts from a Filter Engineer

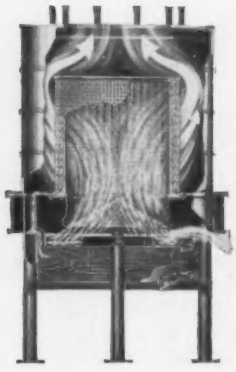
by George Slater

- **NEW LOW PRESSURE DROP FOR OIL BATH FILTERS**
- **IMPROVING ON A "DOG-HOUSE" FILTER**
- **THE MOST COMMON FILTER DISEASE**

NEW LOW PRESSURE DROP FOR OIL BATH FILTERS

In most cases it's desirable to keep an air filter's static pressure loss as low as possible. This is easy to do in a panel or rotating curtain type filter. But until recently it wasn't easy in an oil bath filter unless you used outside pumps or gadgets.

In fact, we believe there's only one filter on the market that, without extra help, provides high efficiency, large dirt holding capacity *and* low pressure drop. That's our LPD design. LPD stands for *L*owest *P*ressure *D*rop. This low pressure drop is accomplished by a design that's radically different from our standard line of oil bath filters. LPD filters were specifically made for a larger range of air flows at resistances as low as 1 inch of water.

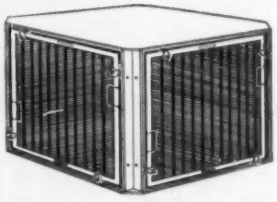


This design improvement has been the result of many years of experience and development. And we're rather proud of it. Of course, LPD oil bath filters do not replace our other line of oil bath filters. They are not made in the smaller sizes because we still have not been able to build the needed flexibility into them. But LPD filters are a step forward in the art of filtration. They are particularly applicable to turbo-charged engines where intake air pressure losses are critical.

IMPROVING ON A "DOG-HOUSE" FILTER

Many filter users require air filter panels held in place in their own plenum chamber. We call these "DH filters"—DH for dog-house—because the plenum chamber, from the outside, looks like a "dog-house". This "dog-house" design has two chief advantages: extremely low pressure loss and very low initial cost. Servicing is easy, too. Generally, spare panel cells are purchased so that dirty filters can be quickly replaced by clean ones and the dirty ones cleaned at any convenient time.

Servicing presented an unusual hazard. In removing the dirty panels, the engine suction could draw in the serviceman's hat, scarf or other unwanted objects. We solved this problem by protecting the intake opening with a cylinder of expanded metal. This provides large enough openings so that air flow is unimpeded but larger objects can't be drawn into the engine.



Of course, this is only a minor advantage. But it's another example of the little extras we build into every Air-Maze product. Taken separately, these extras are not too important. But when you put them all together, they add up to big performance and maintenance savings.

THE MOST COMMON FILTER DISEASE

It's unfortunate that the full efficiency and protection built into a filter can't be realized unless the user cooperates. No matter how successful the filter manufacturer is at extending the servicing period, there still comes a time when some service is necessary. Improper maintenance is the most common disease filters suffer from.

We've tried to analyze why filters aren't treated better. And we think part of the answer lies in the fact that people can't readily understand that filters will save money if kept clean. On a liquid filter, it's easy to see the connection between proper maintenance and reduced costs. Clean filters save on oil. And oil costs money. But with an air filter, it's different. Filter users don't have to buy air. They figure it's free. And they're not quick to realize that if filters aren't cleaned, dirty air gets through and that *does* cost them money.

We've always tried to make maintenance as easy as possible for the user. For example, we supply complete servicing recommendations with every Air-Maze filter. We feel that user and equipment manufacturer alike benefit by paying more attention to the inspection and treatment of filters. No filter in the world can do a good job unless it's properly maintained. The Air-Maze Corporation, 25000 Miles Ave., Cleveland 28, Ohio.

AFI MEMBER AIR FILTER INSTITUTE

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
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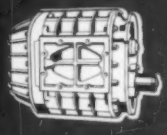

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Specialists for over 37 Years in

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AND

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Schwitzer has extensive Research and Engineering facilities and experienced technicians to develop an economical product—for the Flow of Air, Oil, Water and other Fluids—or the Isolation or Elimination of Vibration in your equipment, whether it is in the Automotive, Atomic, Aircraft, Agricultural, Earth Moving, or other fields.

Schwitzer utilizes the most modern production facilities for the Fabrication, Assembly and Testing of these Precision Products—for high or low volume production.

These services are available to you for product development applications in many diversified fields.

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AT YOUR WEATHERHEAD DISTRIBUTOR

Any hose assembly made in 3 minutes

RIGHT IN HIS OWN SERVICE SHOP!

Now, for the first time, your Weatherhead distributor offers you complete swaged hose assembly service right in his own shop. No waiting for shipments of factory-finished hose assemblies. No need for costly downtime and delay. Equipped with the new Weatherhead swaging press and the complete line of Weatherhead hose and hose ends, your distributor is prepared to supply you with any size, type and length hose assembly at once.

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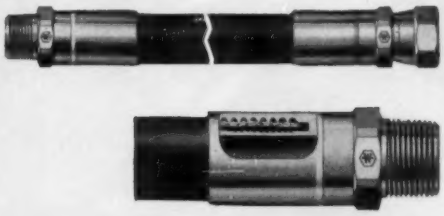

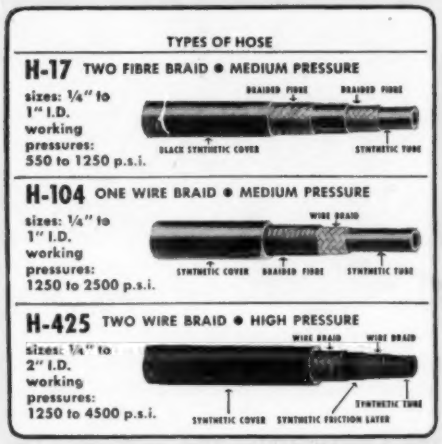

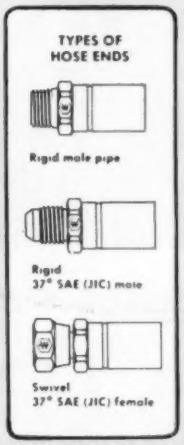

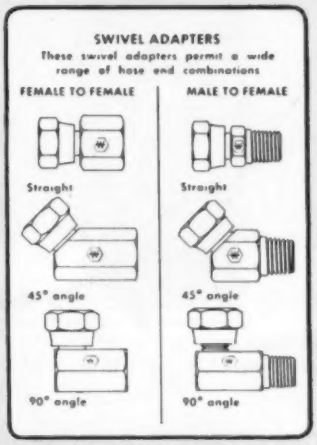

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Send full details on your Distributor's Stand-by Swaged Hose Assembly Service.

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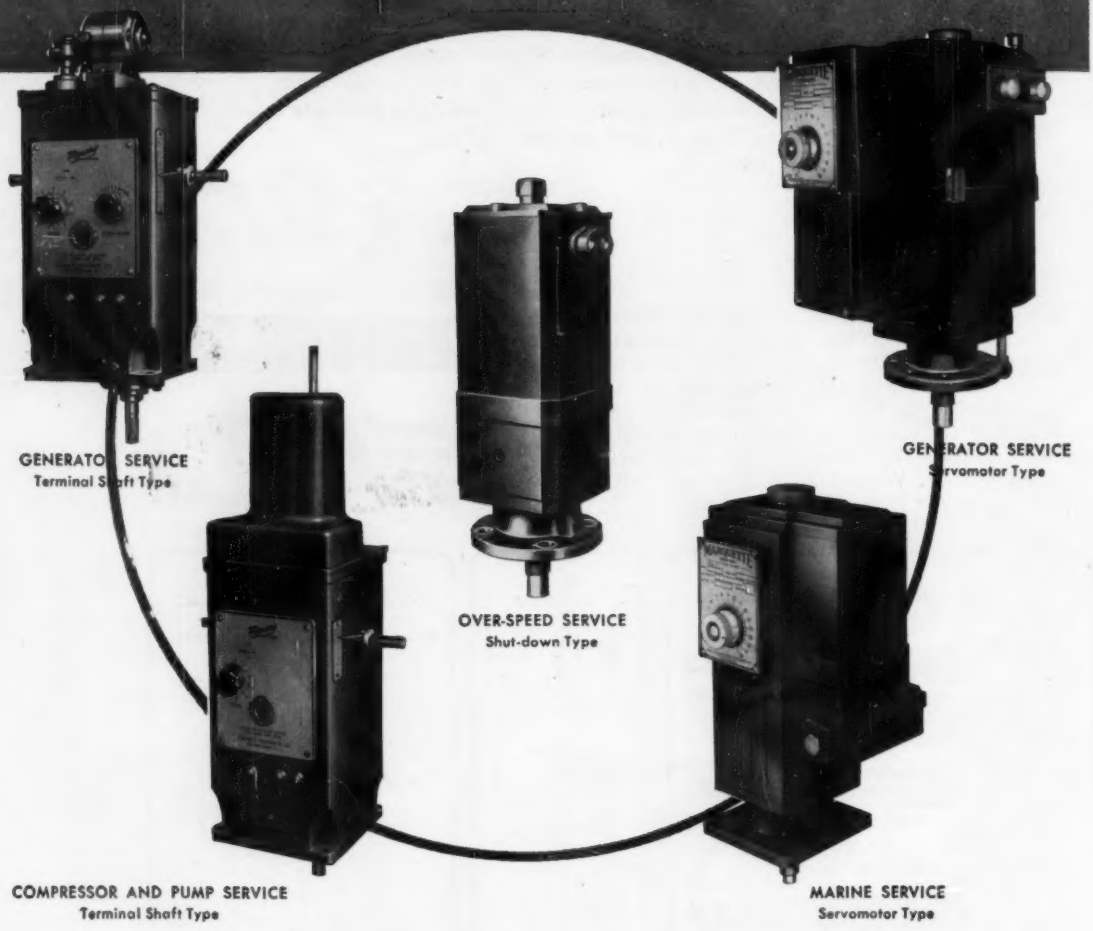

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Servomotor Type

District Service Representatives throughout the United States and Canada. Our combined engineering facilities are at your disposal for all problems of governing and control. Address your inquiries to either company.

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PEDRICK PIONEERED CONFORMABLE OIL RINGS

A perfect seal, with uniform oil control for diesel and gas engines! Pedrick achieved it with the original *conformable* oil ring.

This is the design that made it possible: Two thin, flexible cylinder contacting sections are kept under absolutely uniform tension by the Pedrick "Equalizer." This exclusive feature provides a soft but positive and uniform pressure *all around the cylinder wall.*

The exceptional conformability makes possible more effective oil control with less unit pressure or ring friction. Cylinder and ring wear are reduced and engine overhaul periods are extended. Oil control stays constant for tens of thousands of hours. Carbon pollution is all but eliminated.

Whatever your requirements . . . single rings or engineered sets, it will pay you to insist on Pedrick. Engineering service is available to help you with special problems. Write, phone or wire: WILKENING MANUFACTURING CO., Philadelphia 42. SAratoga 9-3770.

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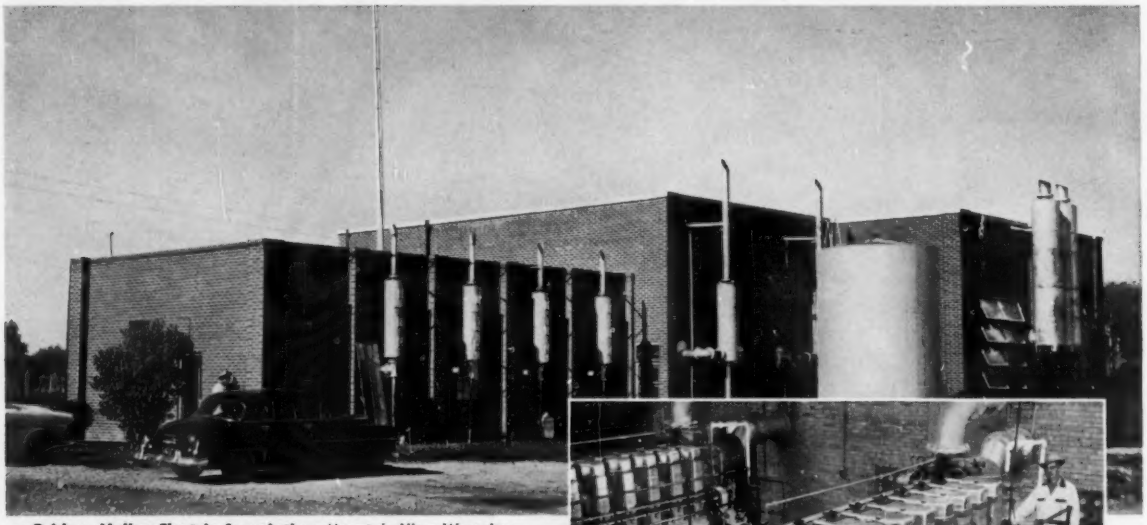
PEDRICK PRECISIONEERING KEEPS PEDRICK FIRST

3 Times the Lube Oil Economy with Enterprise Engines at Lyman, Wyoming



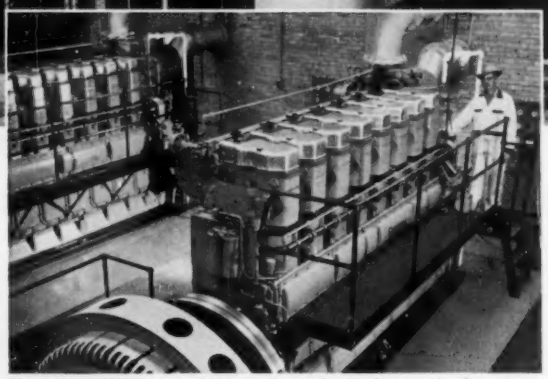
Bridger Valley Electric Association, Mountain View, Wyoming, operates this well-designed diesel power plant at nearby Lyman. Last two units were installed in 1952—both Enterprise DGSG-38 Dual Fuel Engines, rated 925 HP at 450 RPM.

23,597 BHP hours per gallon for entire REA Electric plant*
38,074 BHP hours for the Enterprise Dual Fuel Engines

—more than 3 times the lube oil economy reported by the next best plant!

This record of low lube oil consumption is nothing short of phenomenal. These are the facts from plant records and U.S. Government reports comparing the operating records of 30 REA plants.* It shows that the Lyman, Wyoming, electric co-op ranks first by far in lube oil economy. In every other comparison, too, the Bridger Valley Electric Association plant has established an enviable position through outstanding performance and efficient operation. Since the two Enterprise Dual Fuel Engines were added in 1952, they have virtually replaced the original plant units, which are now used only for peak load and standby service.

If your city or co-op is considering new power in its plan to modernize or expand, it will pay you to plan with Enterprise. Here is dependable, record-proven equipment in the field of heavy-duty diesel, dual fuel, tri-fuel and spark ignited gas engines, 73 to 7703 HP. Write us today for full information, or call your nearest Enterprise office.



Since installation, one of the two Enterprise Engines carries the primary load at all times, alternates with second Enterprise Turbocharged 8-Cylinder unit. Older plant engines are cut in as required during peak load periods. John Brinton is the operator.

Under capable management of William E. Riding, co-op has thrived. Enterprise Engine dependability is proved again: not one enforced shutdown in nearly 30,000 hours of combined operation!

Plant Superintendent Kyle Peterson says: "*Our record of low lube oil consumption is just one of the things we like about Enterprise. They're really fine engines by any comparison, give us everything we expect—and more!*"

*From U. S. Department of Agriculture, Rural Electrification Administration: "Operating Data of Certain REA-Financed Internal Combustion Generating Plants—January 1 to March 31, 1955."

Over a million horsepower at work the world over!

ENTERPRISE
dependable **ENGINES**

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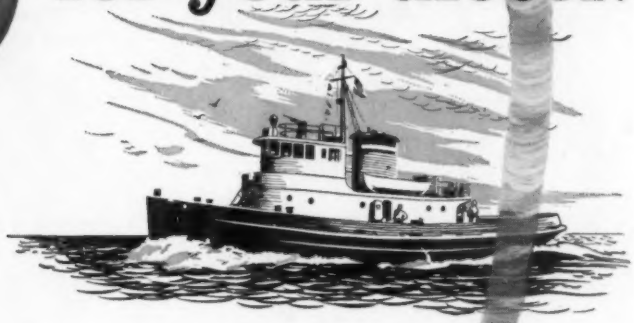
MORE DRIVE

for your diesel!



Here is how the application of AiResearch Turbochargers can affect the performance of your mobile or stationary diesel equipment:

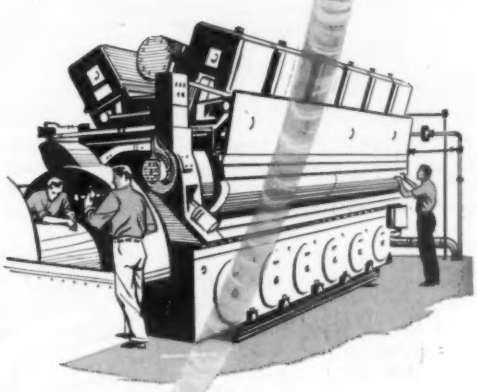
✶ Adds more power in relation to size and weight than any other units in this field.

✶ Decreases fuel consumption. Besides decreasing costs, this factor greatly increases the non-refueling range for mobile equipment.

✶ Provides power as needed by responding rapidly to acceleration requirements. This factor greatly decreases smoking.

✶ Maintains sea-level power under all altitude conditions.

✶ Greatly reduces the noise level of your equipment while eliminating power-wasting mufflers.



AiResearch is the largest producer of small turbomachinery in the United States. Twenty-five *million* hours of experience in deriving exceptional power from small units is the background for the development of the AiResearch Turbocharger. This power package was recently applied to Caterpillar diesel machinery with startlingly effective results.

Your inquiries are invited.

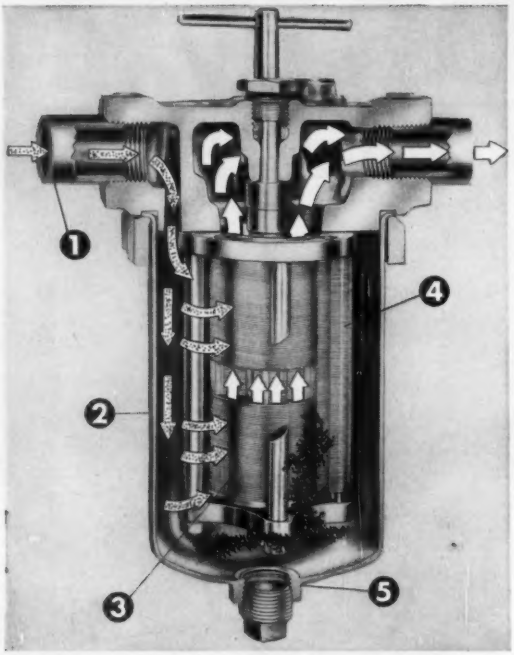
THE GARRETT CORPORATION

AiResearch Industrial Division

9225 Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND RELATED MACHINERY

New CUNO SUPER Auto-Klean Filter can boost engine life up to 50%



HOW IT WORKS. Dirty oil enters inlet (1) at left, fills housing (2) and flows through metal edge-type filter. (3) Clean oil rises through center of filter, leaves at right. Dirt combed out by cleaner blades (4) is removed through drain (5).

Here's what the U.S. Army has done to test Cuno's new 40-micron SUPER Auto-Klean filter for their engines:

They ran destruction tests on several identical engines equipped with different brands of filters. As they ran, dust was introduced into the air intakes. When compression fell to half its initial value, the test was stopped. Best life for engines equipped with cartridge-type filters was 60 hours.

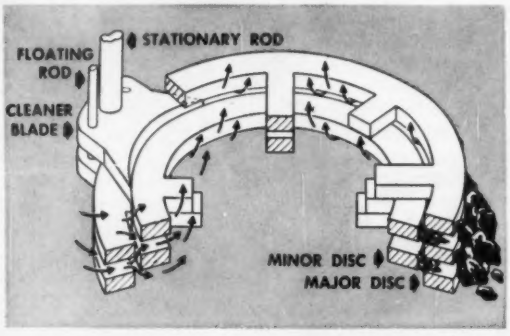
The engine with SUPER Auto-Klean ran 90 hours—50% longer—and *compression was still above half its initial value!*

You can get SUPER Auto-Klean now!

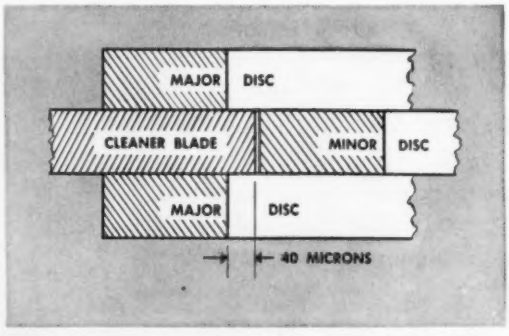
Just specify that the manufacturer equip your new diesel with this latest and best in filtration—both for fuel and full-flow lube. You'll get longer engine life and . . .

1. **Full-Flow** 40-micron filtration with a self-cleaning filter. No cartridge changes; filter can't rupture or channel.
2. **Low pressure drop.** An 8- by 2¼-inch filter element handles 30 gpm of 200 SSU lube oil with only 3 psi pressure drop. You get high capacity in a small package.
3. **All metal.** Can't absorb or adsorb additives from oil.
4. **No interruptions for cleaning.** Handles full flow all the time.
5. **Standard Auto-Klean housing.** On existing engines you can easily replace most 2¼ in. diameter cartridges with SUPER Auto-Klean or simply install SUPER Auto-Klean in the full-flow lube line following the discharge of the engine pump.

Write today for complete technical data on the new SUPER Auto-Klean for your new or existing diesel. Ask for Catalog No. SAK-057. Cuno Engineering Corporation, 9-11 South Vine Street, Meriden, Connecticut. 5.5



FILTER ELEMENT consists of stacked major and minor discs and cleaner blade bearing against precision ground minor disc. Oil flow is shown by arrows.



LARGE PARTICLES (over 0.012 in.) are stopped at space between major discs. Short 40-micron restriction stops 40-micron particles, but allows high flow rate.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

The Engineer's Field Report

CASE HISTORY
RPM Delo Oils
LUBRICANT
Del Este Water Company
FIRM Modesto, Calif.

Engine powers pump for 28,000 hours—sleeve wear is less than 0.002 inch!

PUMPING UP TO 2200 GALLONS OF WATER PER MINUTE, a 165 h.p. natural gas fueled Waukesha engine ran 24 hours a day for more than three years in the Del Este Water Company plant at Modesto, California. Driving a turbine pump, it worked against a constant head, with speed controlled to maintain a set pump discharge pressure. In spite of this tough service, RPM DELO Special Lubricating Oil kept engine in perfect operating condition right up to time of inspection. Oil consumption actually was less for the last 8000 hours service than for the first 8000. Inspection showed sleeve wear only 0.001 to 0.0015" with no taper; crankshaft "miked" within factory standards. As shown above, rings and grooves are clean, sleeves unscored. Same sleeves and pistons were reinstalled and engine went back into pumping service.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

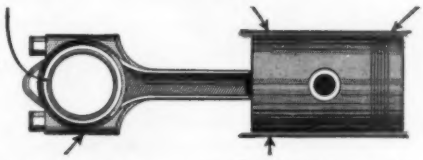
FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why RPM DELO Oils prolong engine life

Special compounds stop corrosion

Anti-oxidant resists lacquer formation

Detergent keeps parts clean

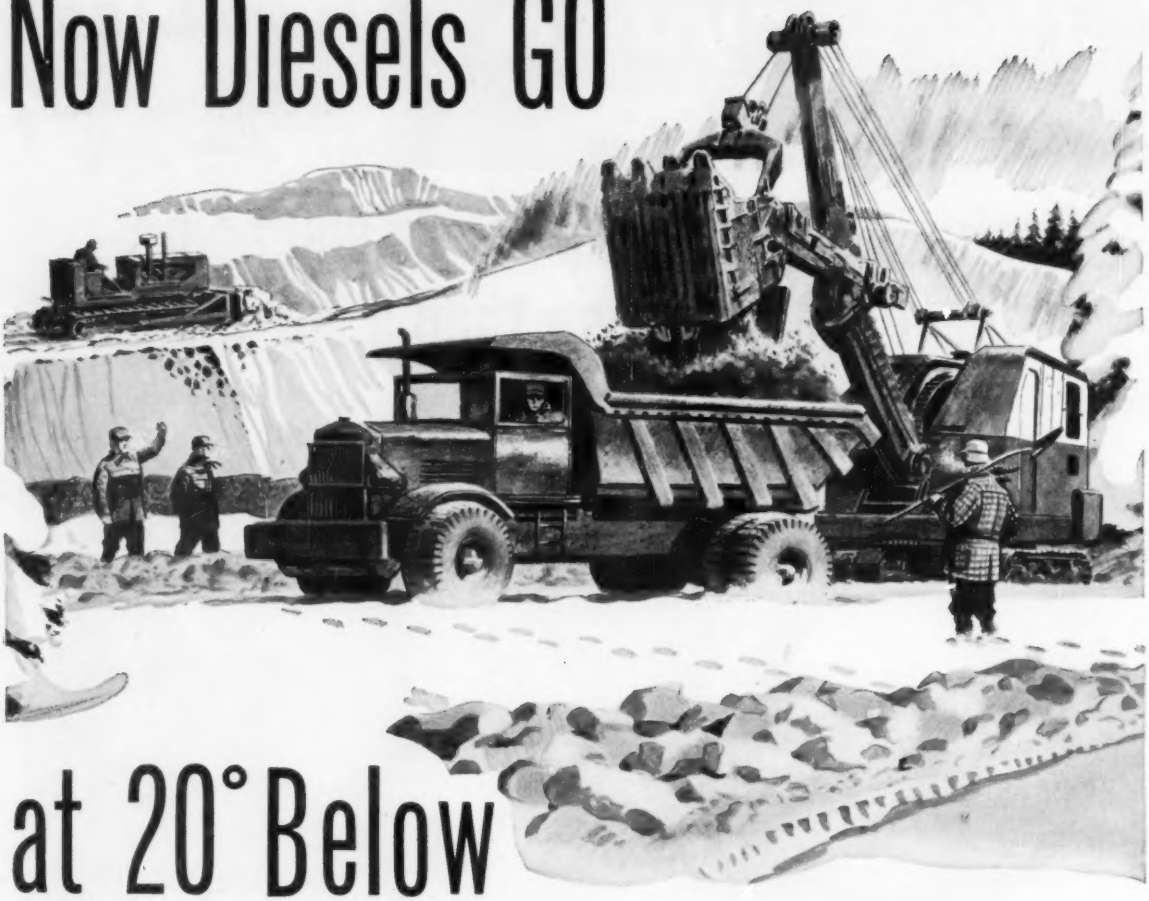


Inhibitor resists foaming

Metal-adhesion qualities keep oil on parts in running or idle engines

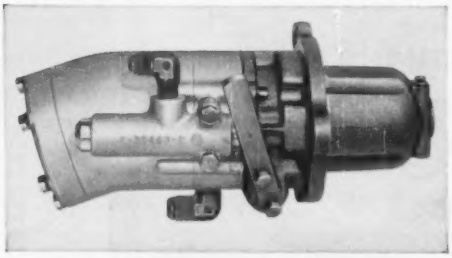
STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

Now Diesels GO



at 20° Below

New Hydrostarter Spins Engines Faster



Heart of the Aeroproducts Hydrostarter is this hydraulic starting motor which spins a Diesel twice as fast as battery-operated starters.

Now, before winter sets in with a vengeance, is the time to put a new, low-cost Aeroproducts Hydrostarter on your Diesel.

Even at 20° below zero, this hydraulic starting system gives you quick, sure starts on every Diesel up to 300 horsepower no matter how long your equipment has been standing idle. The motor delivers maximum torque at all temperatures to overcome starting inertia.

It replaces conventional starting systems, frees you from many maintenance problems and costs less to operate.

And it sells for a far lower price than any other nonelectric Diesel starter available today.

Your Diesel engine or equipment dealer can install an Aeroproducts Hydrostarter on your Diesel in just a few hours' time. He can give you full information—or quickly get it for you. See him today or write direct for full details.

General Motors engineering leads the way

GM GENERAL MOTORS

Building for today... Designing for tomorrow

Aeroproducts

ALLISON DIVISION OF GENERAL MOTORS, DAYTON, OHIO

Cutaway view of Deutz Air-Cooled V-type Diesel, showing finned design around combustion area. Heads and cylinders easily removed individually -

DEUTZ

the world's first full line of

AIR-COOLED DIESELS

With a vast record of successful routine performance in temperatures ranging from 140°F to —40°F, DEUTZ Air-Cooled Diesels are known the world around as the rugged power units that feature dependability, simplicity, and economy.

DEUTZ Air-Cooled Diesels are built with horsepower ratings from 5 to 250, and in 1, 2, 3, 4, 6, 8 and 12-cylinder models. Their air-cooling system provides easier, quicker starting and faster warm-up. They operate at higher temperatures which yield higher efficiency and freedom from corrosion problems related to sulphur content of most fuels.

The greater accessibility of engine parts, with each cylinder and head removable separately in the absence of surrounding water jackets, greatly expedites inspection, maintenance, or repair work when necessary.

DEUTZ also builds special water-cooled Diesels from 3 to 2000 HP for automotive, marine and stationary use.

DEUTZ Diesels, built in West Germany by the world's pioneer in internal combustion engines, are available in your area now. Send in the coupon for complete information.

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Please send complete information on DEUTZ Diesels. I am interested in ☐ Air Cooled ☐ Liquid Cooled Models of about _____ HP.

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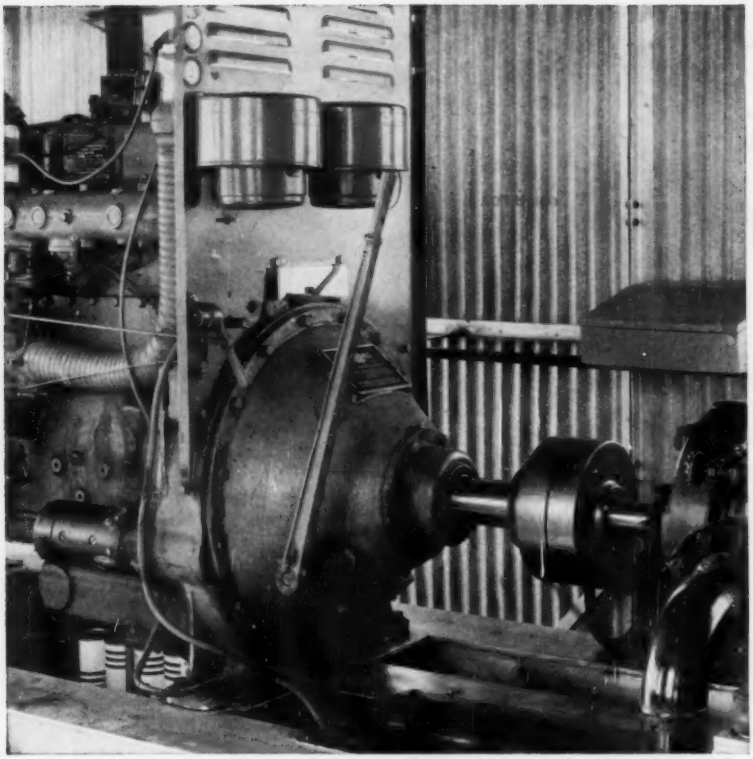

Twin Disc Friction Power Take-Offs are provided in single-plate 6.5" to 24"; double-plate 11.5" to 24"; triple-plate 14" and 18". Housing sizes No. 6 SAE to No. 00 SAE. Capacities to 650 hp. Typical installation shown is on a Waukesha gas engine. **Request Bulletin 129-C.**

Known by the power it applies

To both the engine manufacturer and user, the power take-off—connecting driving and driven equipment—is one of the most critical components in the driven line. Here is the vital link where all horsepower and torque must be transmitted before any work is accomplished . . . a link which can become a costly "Achilles" heel through failure on the job.

In specializing exclusively since 1918 in the design, manufacture and application of industrial drives for powered equipment, Twin Disc has developed Friction Power Take-Offs that assure trouble-free operation throughout the working life of machines to which they are applied. Designed for superior performance, they are backed for their lifetime with unparalleled service.

That's why the Twin Disc Power Take-Off is known by the power it applies. Throughout industry, you see them behind engines built by the world's leading manufacturers . . . for both manufacturers and users know *this* Power Take-Off will never become an "Achilles" heel on the job, to either operation costs or production schedules.

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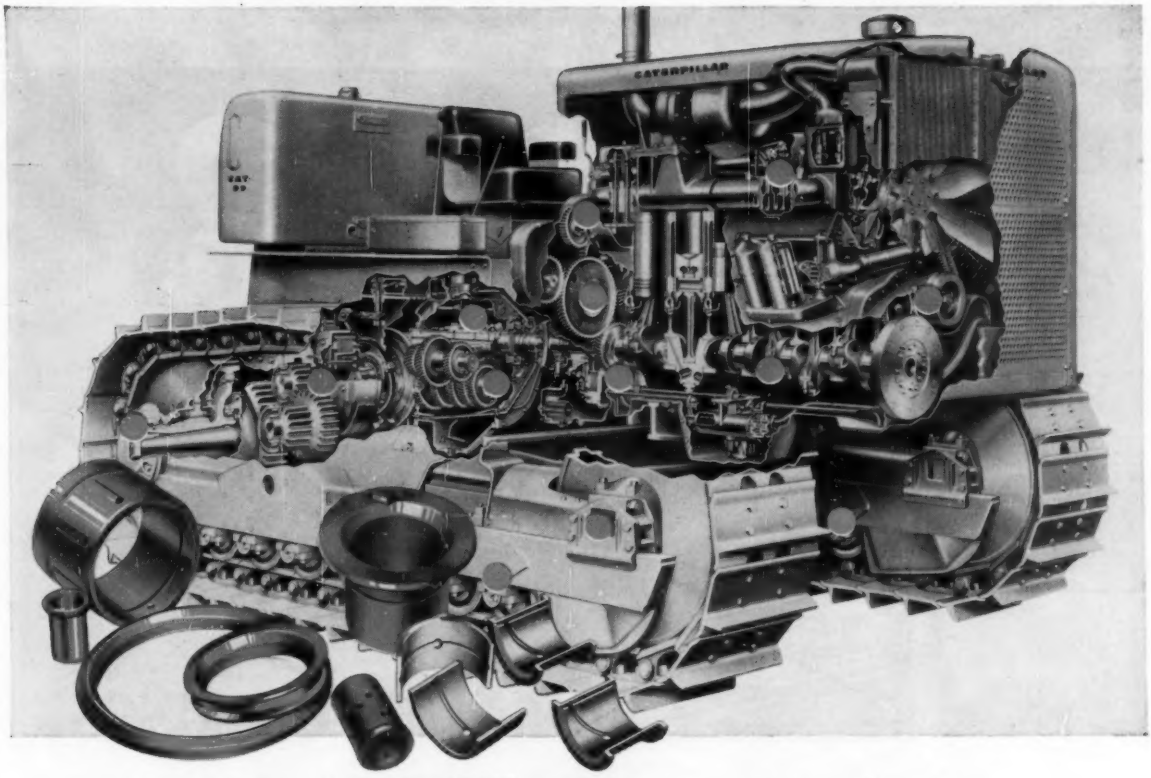


Dependable Johnson Bearings

Help Give Long Life To Big Cat Machinery

Engine bearings and bearings in track rollers and other components play a big role in the ability of Caterpillar Diesel Tractors to give long, satisfactory performance on tough jobs.

Caterpillar Tractor Co., manufacturers of the big yellow, earth moving rigs you see at every hand, makes certain that each part has the quality and stamina to give trouble-free service.

The ability of Cat equipment to handle difficult assignments depends in part on bearings obtained from Johnson Bronze Company of New Castle, Pa., which supplies a wide variety of the bearings used throughout Caterpillar products.

Dependable Johnson bearings—made of aluminum on steel, babbitt on steel, cast bronze, bronze on steel, and sintered bronze powder (Ledaloyl)—help Caterpillar meet its triple objective of: 1. durability, 2. bigger pay loads, and 3. longer life. Johnson also offers Caterpillar sound engineering help, has a complete line, maintains uniform high quality and consistently meets Caterpillar's specifications.

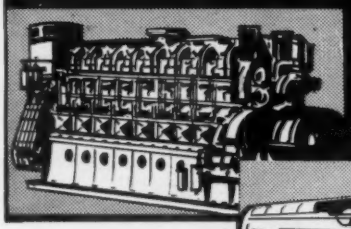
This is a typical example of the service Johnson gives many manufacturers in all industry by supplying them with many types of bearings for a wide variety of applications—from automobiles to sound recorders—from automatic washers to machine tools—to name but a few.

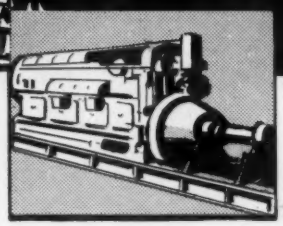
To enjoy the dependability and economy of Johnson bearings in your products, write for information on how Johnson engineers will work with you to make a better product at lower cost. Johnson Bronze Company, 470 S. Mill Street, New Castle, Pennsylvania.

Johnson Bearings

LEDALOYL (powder metallurgy) • ALUMINUM ON STEEL • BRONZE ON STEEL • STEEL AND BABBITT • CAST BRONZE

DISCOVER the BIG DIFFERENCE





DaRoS PISTON RINGS ARE BETTER—3 WAYS!

1. DaRoS, and only DaRoS, offer rings made of world-famous Swedish Charcoal Iron — engineered and produced by "old world" craftsmen at Davy Robertsons Maskinfabrik.
2. That's why DaRoS Rings have a lower rate-of-wear than other makes. 50 to 90% lower! Wear on cylinders is less, too! That means thousands of more operating hours between ring renewals and cylinder re-conditioning! Less "down-time" for your equipment.
3. DaRoS Rings also cut fuel costs 10 to 15% because they constantly maintain complete efficiency in either worn or new cylinders — there's no leakage — no blow-by.

One installation will convince you. Write, wire or phone for recommended application and prices now.

IMMEDIATE DELIVERY FROM CHICAGO on Popular Sizes

(This is ad #8 in a series designed to tell Diesel Operators the important story about DaRoS Swedish Iron Piston Rings.)

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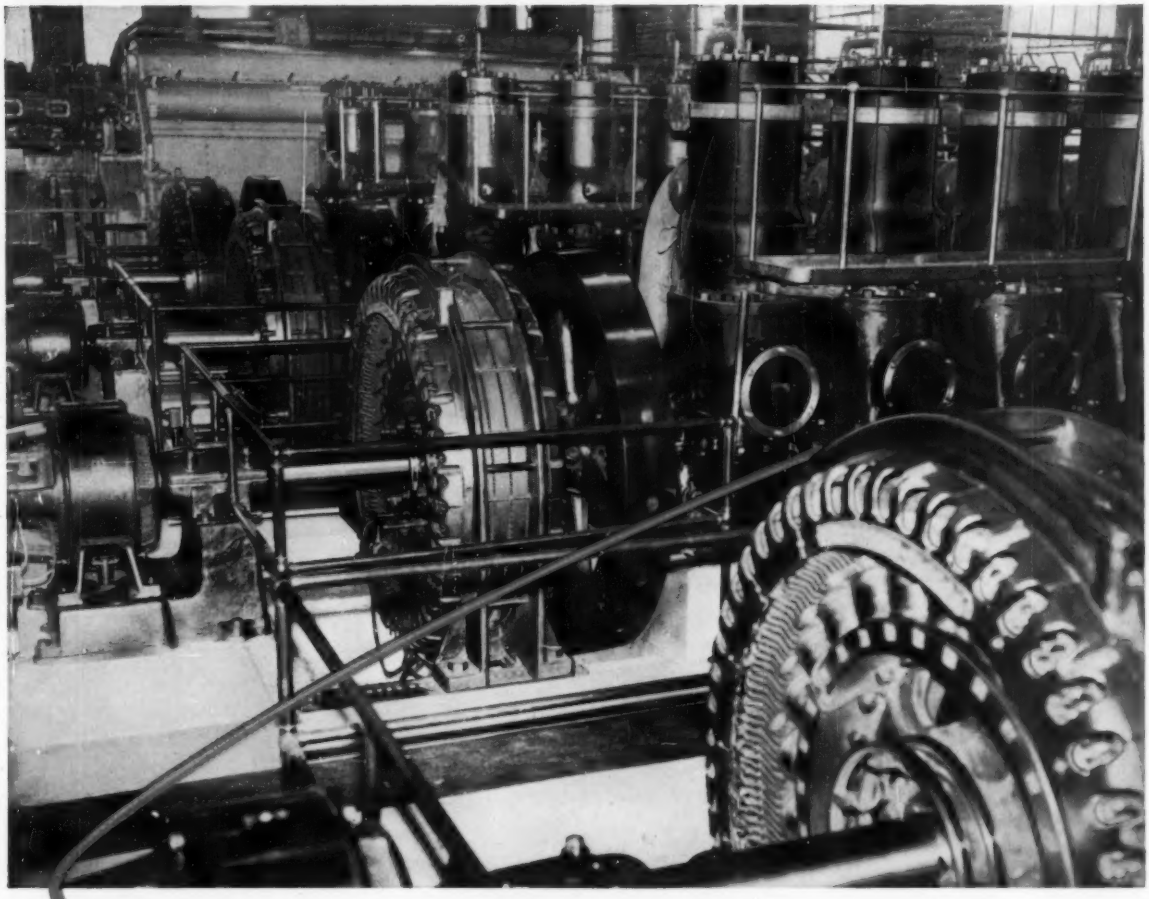
AMERICAN CORPORATION

D. D. Cook, President

8128 N. LAWNDALE AVENUE • SKOKIE (Chicago Suburb), ILLINOIS, U.S.A.

Distributors for North, Central and South America

Resists Wear!



Switch now to Sinclair GASCON® Oils for top anti-wear lubrication and longer engine life in your diesel engines.

Actual performance results prove that the superior GASCON Oils eliminate stuck piston rings, reduce carbon deposits on vital engine parts, cut cylinder wear to a minimum . . . and improve the ratio of KW-HRS. per GALLON of Lubricating Oil.

Sinclair GASCON and GASCON H.D. Oils *can save you money* by assuring longer bearing life . . . higher productivity . . . lower operating costs.

See your Sinclair Representative today for further information or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

GASCON OILS

It's time you asked:

What's behind the success of aluminum bearings?

Since Alcoa first introduced them in 1938, aluminum bearings have been making deep inroads where bimetallic bearings were considered standard. Little by little, management groups in all industries have seen competitors' problems solved by the adoption of them—and hundreds have asked, "What IS behind the success of aluminum bearings?"

For one thing, aluminum bearings are *one piece.* Heat is evenly distributed, quickly dissipated. The relative softness of aluminum bearing materials prevents scoring of shafts by dirt particles. Yet aluminum is hard enough to groove slightly, and "roll out" particles, and allow them to be trapped by the oil filter. What's more, these long-lasting bearings in many cases actually *cost less than the bearings you're now using!*

Alcoa's team of research and development engineers spent years in the development of this special bearing alloy. These men, already familiar with the railroad industry, knew the alloy must have optimum resistance to corrosion; must offer the last word in load-carrying ability.

Working hand-in-hand with Fairbanks-Morse, these Alcoa engineers developed, machined and installed the world's first aluminum bearings for diesel locomotives. Now, after years of trouble-free experience with them, Fairbanks-Morse specifies Alcoa® Aluminum Bearings for the full engine set in their great new TRAIN MASTER Locomotive!

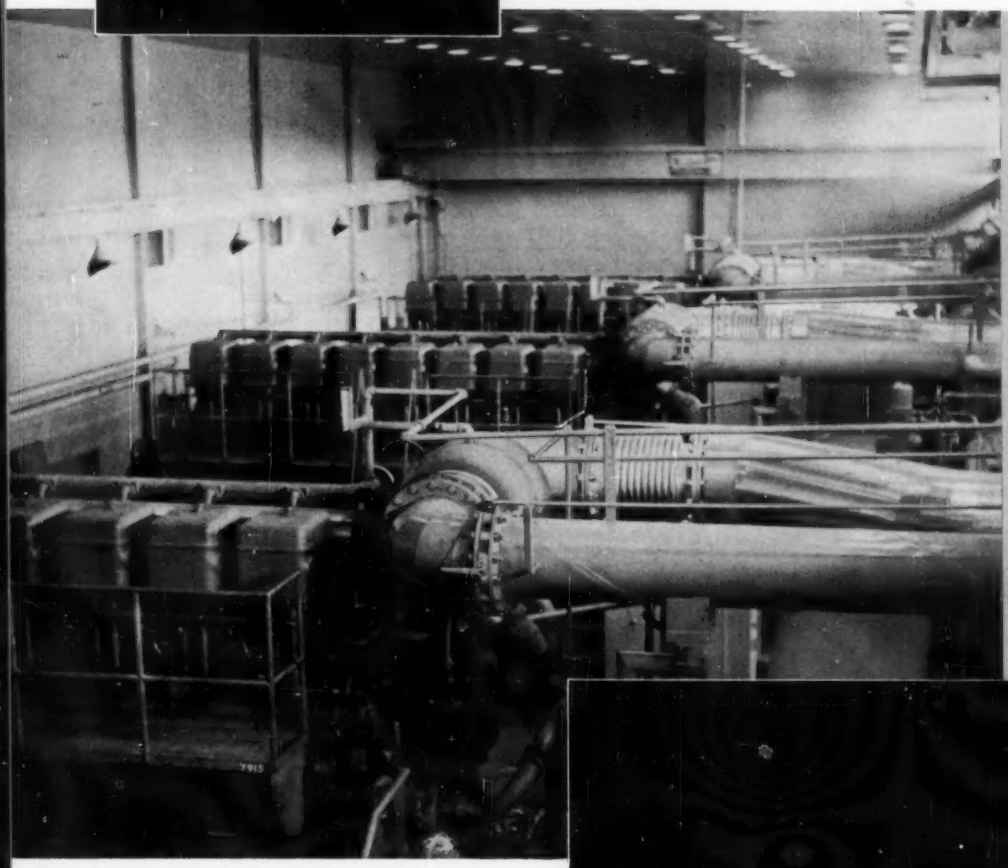
So, it's time you asked, "What's behind the success of aluminum bearings?"—and the man to ask is the Alcoa sales engineer, or call your nearby Alcoa sales office. The number is listed under "Aluminum" in the classified section of your telephone directory. Or write: ALUMINUM COMPANY OF AMERICA, 1988-H Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to Aluminum Value

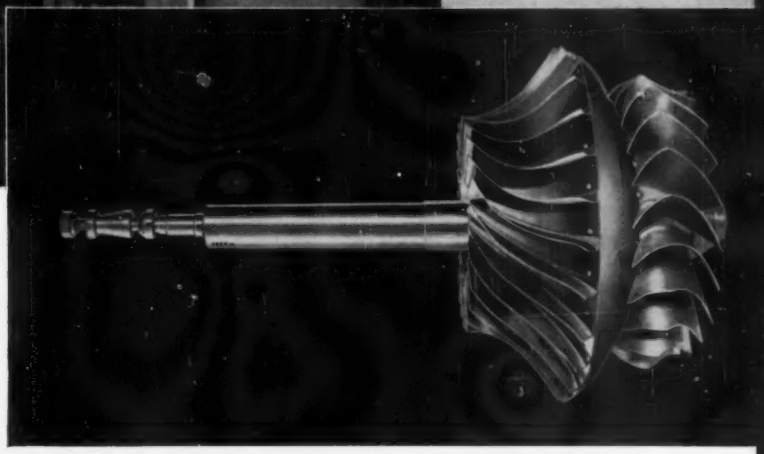
FASTEN ALUMINUM WITH ALCOA ALUMINUM FASTENERS

DE LAVAL
HIGH PRESSURE TURBOCHARGERS

efficiently serve diesels at Lakehead Pipe Line Company



Exclusive
MONOROTOR
Construction



Located in an outlying district in Northern Minnesota, this oil pumping station of the Lakehead Pipe Line Company must have *dependable, efficient* equipment. That's why Nordberg Diesel engines *with De Laval High Pressure Turbochargers* were chosen for this service.

The De Laval turbochargers efficiently utilize the exhaust gases to supply the high intake air requirements of these 1800 BHP, eight cylinder, four-cycle Supairthermal engines. Shown in the photograph are three units. Six other identical engines operate in pairs in three other stations of this company.

Due to the exclusive Monorotor design, De Laval High Pressure Turbochargers have a pressure ratio up to 3:1, as well as far higher pressure and turbine efficiencies than those found in conventional turbocharger systems. They are self-adjusting to engine loads, can be used with 4- *and* 2-cycle engines.

Write for De Laval Bulletin 8000 giving comprehensive curves and flow range diagrams.

DE LAVAL *Turbochargers*

DE LAVAL STEAM TURBINE COMPANY
890 *Nottingham Way, Trenton 2, New Jersey*

DL 324

Now available on

Hydrostart

IF you're running a General Motors Detroit Diesel far from civilization—or in extremely cold weather—here's a new low-cost hydraulic starting system that insures fast starts every time.

This Aeroproducts Hydrostarter spins a Diesel fast, has no parts or components that require regular replacement, costs less to maintain than electric starting systems.

It sells for a lower price than any other nonelectric Diesel starter.

And it's available today from your General Motors Diesel distributor.

EASY TO INSTALL SIMPLE TO MAINTAIN

Your GM Diesel distributor or dealer can quickly install the Hydrostarter on your Detroit Diesel engines. The system is simple. All it takes is a few hours' time for installation, and arrangement of some of the components is optional.

With a Hydrostarter on your Detroit Diesel you'll free yourself from the usual starting problems. The system is completely self-contained—normal routine maintenance checks are all the care it ever needs.

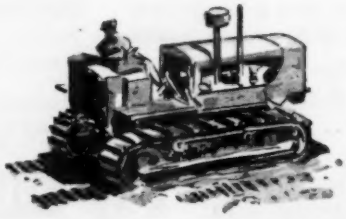
HOW IT WORKS

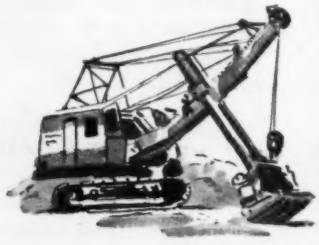
Heart of the system is a hydraulic starting motor operated by oil under high pressure. An engine-driven pump builds up and maintains pressure in a piston-type accumulator.

To start a General Motors Diesel equipped with a Hydrostarter, the operator opens a simple control lever to admit this oil to the motor which spins the engine. The control lever also completely engages the starting motor's gears with the flywheel before operation.

Your mechanics will get good use from the hand-operated pump which can be used to rotate the engine's flywheel slowly for timing adjustments. This pump can also be used to raise pressure if needed. The oil supply is stored and filtered in a reservoir.

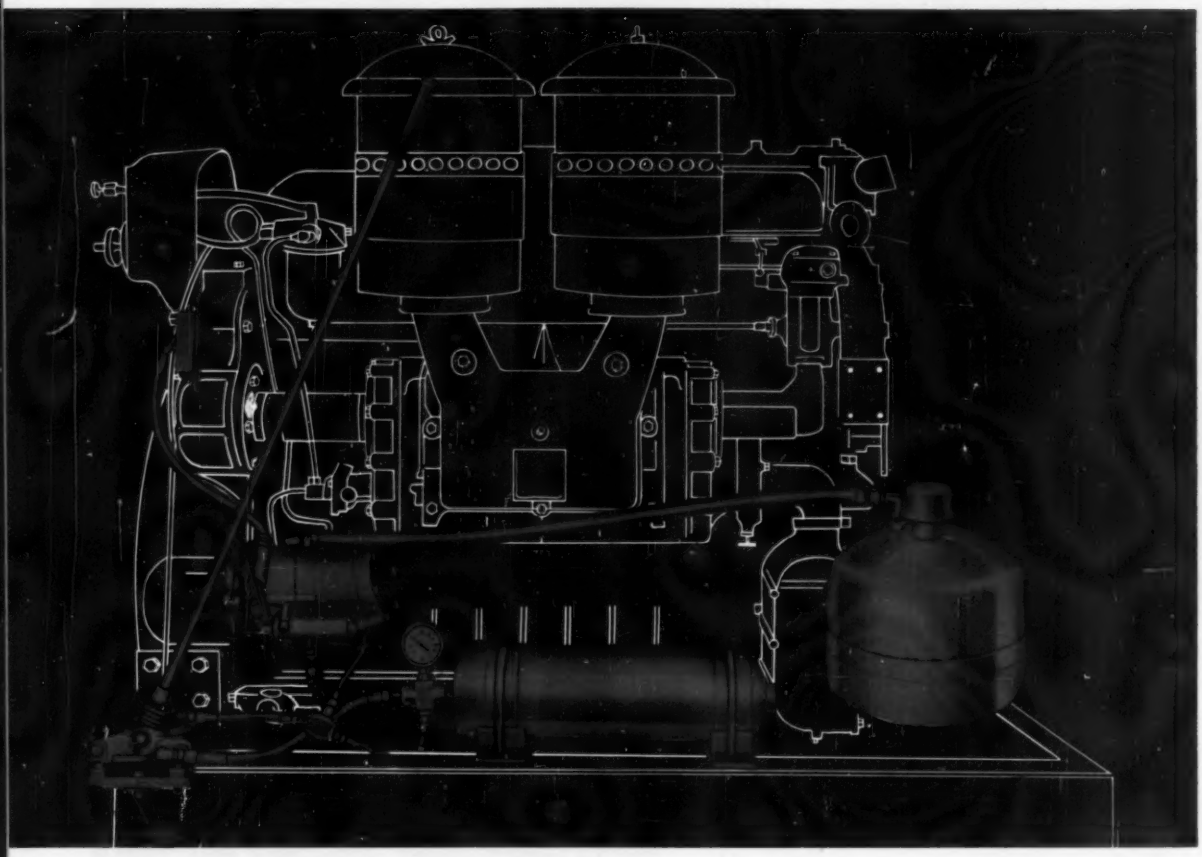
Right now—before winter sets in with a vengeance—is the time to see your GM Diesel distributor about the new Hydrostarter. He can quickly install this new starting system on your Detroit Diesel engines—or can give you full information on the new Hydrostarter.





Detroit Diesel Engines—

er NEW LOW-COST HYDRAULIC STARTING SYSTEM



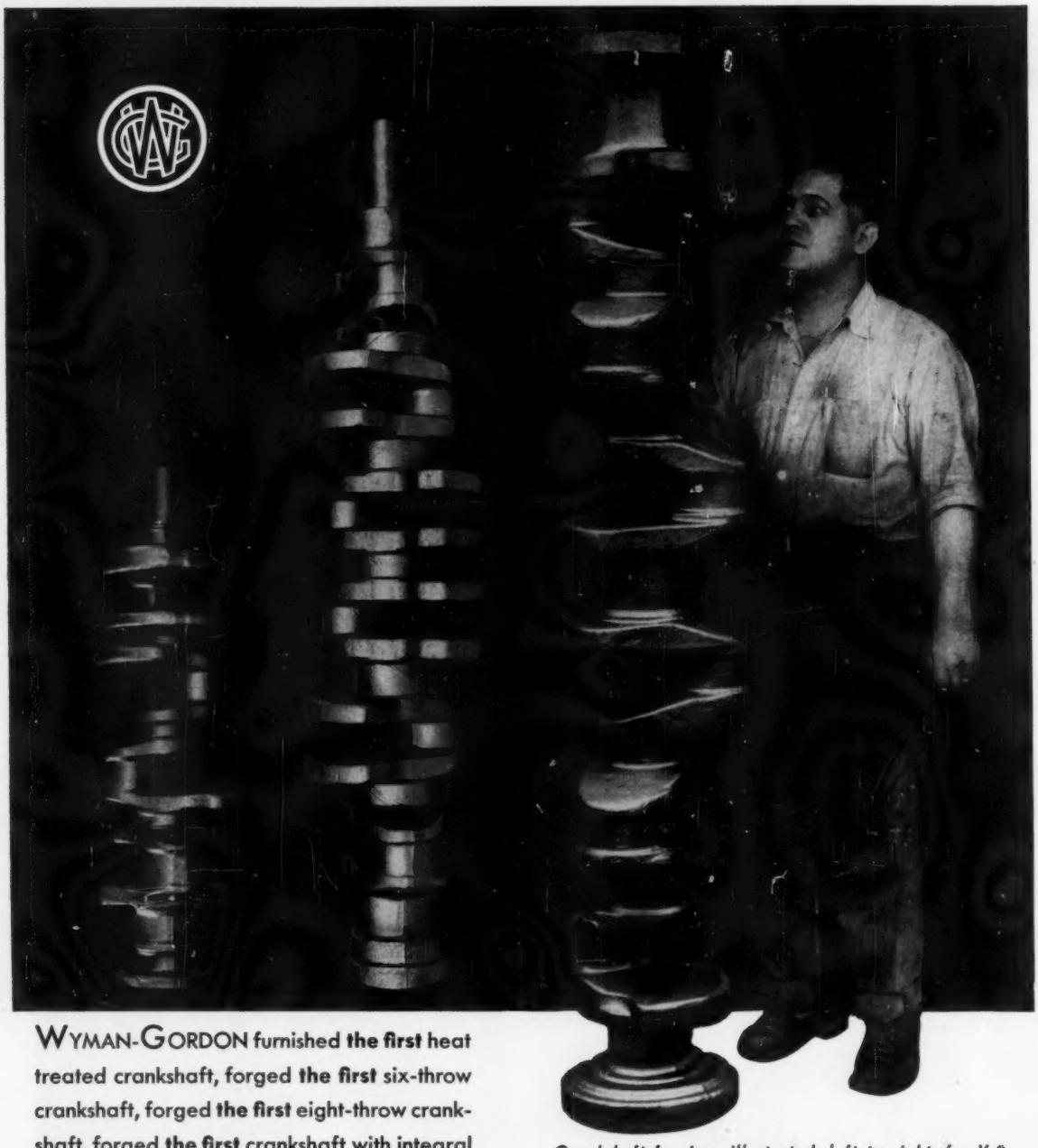
DETROIT DIESEL

ENGINE DIVISION OF GENERAL MOTORS

America's Largest Exclusive Builder of Diesel Engines

Single Engines . . . 30 to 300 H. P. *Multiple Units . . . Up to 893 H. P.*

GM GENERAL MOTORS DIESEL POWER



WYMAN-GORDON furnished **the first** heat treated crankshaft, forged **the first** six-throw crankshaft, forged **the first** eight-throw crankshaft, forged **the first** crankshaft with integral counterweights, and today forges a larger quantity and a greater variety of crankshafts than any other company in the world.

In a crankshaft there is no substitute for a forging, and in a forging there is no substitute for Wyman-Gordon quality and experience.

Crankshaft forgings illustrated, left to right, for V-8 passenger car, diesel truck and heavy tractor engines

WYMAN-GORDON CO.

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM
STEEL • TITANIUM

WORCESTER 1, MASSACHUSETTS
HARVEY, ILL. • DETROIT, MICH.

Getting More from Less

Today's definition of space might be "that which you don't have any more of to put a bigger engine in." And everyone wants a bigger engine—at least bigger in output. Engineers go around muttering over and over, ". . . . gotta cut weight, gotta cut size, gotta get more power . . ." Homes may be broken up and they may get ulcers but today's crop of engines show that they're doing these things. It's remarkable that there's no one royal road to follow; there are a number of approaches. This freedom of choice bodes well for our industry since it implies tremendous unexplored areas. Three papers from SAE's Golden Anniversary Diesel Engine Meeting illustrate the diversity of ideas. Earl C. Ginn of Continental outlined a vee-engine design to provide ". . . decreased installed bulk, reduced specific weight, increased flexibility and speed . . .". Plus higher cylinder pressures, rpm is being stepped up to approach gasoline engine values. Higher speeds in vehicular engines mean greater vehicle flexibility and smaller driveline components because less torque is transmitted for the same horsepower. Higher bmep's and rpm—that's one approach. Then W. F. Burrows and H. W. Hanners discussed development of White Motor's new V-106 diesel. Details are in this issue. Suffice to say here that by eliminating components of more complex engines through use of a loop-scavenged, 2-cycle design, more room is left for cylinder displacement, a sure-fire path to more power even though bmep's are lower. You can wind such an engine up higher too.

Finally, Ernest Chatterton of Napier flew over from London to talk about his remarkable Deltic engine. If you don't know the engine, three opposed-piston cylinders are arranged in a triangle with a crankshaft at each corner. Up to six triangles are used, making an 18-cyl engine. Commercially, 1725 hp at 1500 rpm is produced. Weight for this rating is about 5.2 lb/hp. Here's a prime case of space utilization to provide high cylinder displacement. Turbocharging is on the boards and they even propose to use the center of the triangles for an axial-flow compressor in a compound engine-turbine unit. There's more to tell but space we do not have any more of, too.

BPE

Cyclan

RING IRON
has high resilience

- Retains true shape even after much deflection.
- Combines the best characteristics of iron and steel.
- Equals or surpasses the wearing quality of cast iron.
- Approximates the strength of steel.
- Has extra high impact value for shock resistance.
- Stands up in super-charged engines.
- Can be readily chrome-plated.
- Functions efficiently without chrome plating.
- Now used for original equipment in heavy duty engines.
- Now available for replacement use.

Cyclan is exclusively a Sealed Power development

Write for "The Cyclan Story"

SEALED POWER CORPORATION
MUSKEGON, MICH.

Sealed Power
PISTON RINGS • PISTONS
CYLINDER SLEEVES

highlights

- Figures released by ICC's Bureau of Transport indicate that as of the end of 1954, more than 98% of the diesel-electrics serving on Class I railroads were built in the last 15 years of that period. Of these 54% were built in the last five years.

- The Plant Maintenance & Engineering Show is returning to Philadelphia Jan. 23-26. A yearly event, this is the second time that it will be held in the East.

- The great wilderness of northern Quebec will soon be awakened from its slumbers by hundreds of miles of bisecting railroads. They will open up an immense mining area and, of course, increase the use of diesels in all fields.

- Economical diesels have not only pushed steamers off the railroads, they've also invaded the private networks of major manufacturers. Republic Steel, for example, is using 15 diesel locomotives around its big Cleveland mill and has just announced plans to order 11 more and retire the last 14 iron horses still puffing around.

- Twenty-four diesel-engined trucks and 22 hi-cube trailers are the latest addition to the Foster Freight Lines' fleet.

- A new refining process that gives gasolines of more than 100 octane has been developed by Universal Oil Products Co. The process, called "Rexoforming", is said to be an advance over the platinum catalyst refining method now used.

- The US Labor Dept. says that 28 railroads are participating in a national apprenticeship program to develop craftsmen for maintenance shops. More than 2000 men are now training under these registered programs.

- Britain is building a miniature railway system with 3 3/4 mi of straight and curved track. Purpose is to test performance of rolling stock and track in various stages of wear. Part of a $3.4 billion plan to introduce diesel and electric equipment throughout England, the $1 million proving ground is said to be the first of its kind in Europe.

- Italy, land of the motor scooters, is now manufacturing a tricycled vehicle which uses a single-cylinder 6-bhp horizontal diesel. It's intended for short-distance hauling.

- Some full-load operation is necessary in engine break-in. From an SAE panel report by H. F. Galindo, California Research Corp.—An automotive diesel benefits from a 3-hr break-in period, starting with idle and applying 1/4-load increments so spaced that the period ends with brief full-load operation.

- Buttoning up its 10th year as a self-sustaining utility, the B. C. Power Commission has met postwar rural power demands with 19 diesel-electric generating stations having a total 26,166-kw capacity. Half of the customers served in the province had no electricity until supplied by the commission.

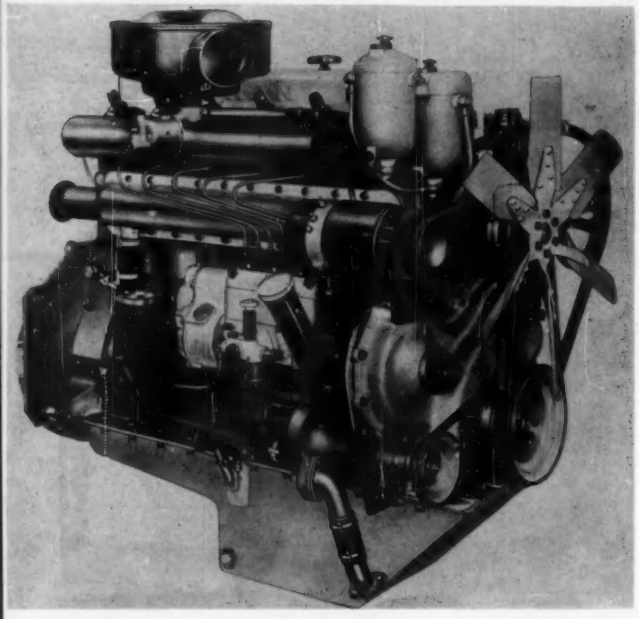
- Hanseatische Motorengesellschaft, a West German outfit, is planning to set up a diesel engine factory in Turkey.

- John W. Hobbs Corp. announces that its engine hour meters are now standard equipment on all industrial engines manufactured by Harnischfeger's P&H Diesel Div.

- New York City is seeking assistant mechanical engineers and electrical and mechanical engineering draftsmen. Jobs are open to non-residents. File forms can be obtained from Application Section, Personnel Dept., 96 Duane St.

- Class I rails reported 816 new locomotives on order as of Oct. last. All were diesel-electric except for 12. Compare this to last year at the same time, when 115 units were on order, of which 104 were diesel-electric.

- Latest devices added to Union Pacific's battery of research instruments are an electron microscope which can magnify elements to 20 times their size, and an emission spectrograph. They'll be used in studying metals and lubes. For example, if a diesel oil is suspected of having metal fragments, they'll find them and then track down the exact piece of the engine the metals came from.



Naturally-aspirated, 6-cyl MAN "whisper" engine moves truck uphill at 5 mph in high gear without stalling; accelerates quickly without knocking.

MAN's "Whisper Engine"

By Joseph S. Cascio
Special Assistant to Editor

FOR a diesel engine that operates so quietly that it is called the "whisper" engine, it's amazing how it is being heard around the world. This engine built by MAN, incorporates a new combustion chamber design developed by Dr. Meurer. It is said to have all of the following features.

1. *Diesel knock is eliminated even at low speeds, resulting in a noiseless, relatively vibrationless engine with extreme elastic torque characteristics.*

2. *Operates with fuels ranging from gasoline to diesel fuels without sacrificing engine performance and quick cold starting.*

3. *Its combustion produces less soot per pound of fuel at part load than do conventional systems.*

4. *Has lube oil contamination no greater than in gasoline engines.*

Such an engine is not only possible but an actuality according to a report recently submitted to the SAE. This paper, entitled "Evaluation of Reaction Kinetics Eliminates Diesel Knock. The M-Combustion System of M.A.N.", was presented by Dr. J. S. Meurer, of the M.A.N. Co. of Nurnberg, Germany. Incidently, it was at this same MAN factory that Dr. Diesel built and successfully operated his first engine.

In his discussion Dr. Meurer unveils a new theory of combustion. This theory knocks into a cocked hat the modern concept of what should occur in a conventional combustion chamber to eliminate knocking and smoke.

This engine is said to run so quietly that people in Germany who are accustomed to the normal loud diesel operation have dubbed it the "Whisper-Motor". And they should know since they can judge by the many trucks and buses which are equipped with these MAN diesels. The noise level of this engine is equal to 90 phons as compared to 85 phons for a similar size gasoline engine.

Reviewing Combustion In Conventional Diesel

Let us review first the modern concept of what should occur in the combustion chamber of a conventional diesel engine. From the beginning of high speed diesel development, mixture formation has been considered the key problem since such little time is available. The tendency has been to blame deficient mixture for all difficulties in diesel combustion, such as steep pressure rise, poor air utilization, noise and smoke.

For years engineers have maintained that the ideal, is an instantaneous mixture of fuel spray with compressed air. A large variety of combustion chamber and nozzle designs have been evolved to achieve this end. Direct injection systems generally rely on the combination of two effects to create proper air-fuel mixture, namely:

1. *atomization and distribution of fuel by the nozzle*
2. *motion of air in the combustion chamber.*

According to the Meurer report, while engineers have been concentrating on air-fuel mixture, they have neglected another, no less important aspect: *the chemistry of diesel combustion.* Heat liberation in a diesel and consequently its performance depend essentially on the combustion process. It is therefore almost more important to provide conditions favorable to the process itself, than to insure a thorough mixture.

Dr. Meurer asserts that in the light of recent experience the concept of ideal air-fuel mixture can be refuted as fundamentally wrong. The reason—it ignors the actual sequence of action in the combustion process of diesel fuels. For proof as to the extent to which performance characteristics of a diesel could be improved by better mixture formation, this experiment was cited. Photographs were taken of a specially designed nozzle injecting fuel into a spherical chamber. These showed that at the end of injection every fuel particle was surrounded

MAN's new theory of combustion in high-speed diesels questions conventional concepts. M-System incorporated in vehicular engine shows some remarkable results.

Normal Diesel System		MAN M-System	
100% of injected fuel		100% of injected fuel	
1) Injection into air	of liquid fuel	1) Injection of liquid fuel	
		about 5% in the air	about 95% on the wall
2) Mixing with hot air.		same as in normal Diesel engine (see left)	2) Evaporation at low temperature under lack of oxygen. Slow preoxydation.
3) Evaporation at high temperature in presence of oxygen.			3) Mixing of fuel vapor with air.
4) Autoignition of incontrollable quantities of fuel (low ignition temperature); decomposition to carbon.			4) Ignited by incandescent carbon particles produced by autoignition of air distributed droplets
5) Combustion with high reaction rate at the start, increasingly inert toward the end.			5) Combustion before autoignition occurs

Comparison of injection, fuel conditioning and combustion in standard diesel to M-System.

by enough air for complete combustion. Also, that the spray was well adapted geometrically to the shape of the combustion chamber.

However, although the nozzle design was a success, actual engine testing resulted in combustion knock and exhaust smoke over the entire load and speed range. This confirmed the incredible but true conclusion that an ideal mixture is a handicap to combustion. *In other words, during ignition lag, fuel somehow cannot stand being mixed with air at all.* Combustion noise became louder if air or spray velocity or both were increased. The engine ran smoother but smoking increased if fuel rate at the beginning of injection was reduced. According to Dr. Meurer, it is obvious that defects of diesel combustion didn't arise solely from limitations of mixture formation. There had to be some reactions of the fuel which hampered combustion. Dr. Meurer sums it up this way.

In a diesel, direct oxidation of the original fuel molecule into its final products cannot cause self-ignition. Rather, oxidation takes place through intermediate products whose reaction is extremely rapid.

Temperature at the beginning of injection is about 1100°F and rises fast when reaction starts. Local flame temperatures reach a maximum of 3800°F. This indicates that when burning begins, mixture constituents are in the liquid or solid state. These particles then form radiation centers and ignite the remaining mixture.

If collisions of sufficient energy occur between fuel and oxygen molecules there is liberation of heat. If no oxygen is available, fuel, a hydrocarbon, is decomposed into hydrogen and carbon. How completely these cracked products burn depends on the amount of oxygen supplied through mixture formation. But rising temperature widens the discrepancy between cracking rate and oxygen supply and eventually it is only carbon which remains.

Burning this carbon early enough presents a problem as indicated by exhaust smoke. This problem can only be solved by the catalytic influence of water vapor produced during combustion, (as per the equation $C+H_2O \rightarrow CO+H_2$) and subsequent reoxidation. This catalytic influence is effective only if H_2O is formed close to the molecule. *In short, only if the H_2 and C reactions start at least at the same time, and the H_2 reaction precedes at a faster rate and before pure carbon has formed.* The way to achieve this without starting the temperature propelled avalanche of thermal disintegration, is by means of pre-oxidation that proceeds slow enough to suitably transform the surface of the molecule.

Briefly, the higher the temperature the less chance there is to produce a perfect mixture of air and vapor from the liquid particle. As the fuel molecule disintegrates, the oxygen being supplied at a relatively slow rate compared with molecular break-down, is used up in a chain of auto-ignitions of activated fractions before a uniform mixture can form. A carbon skelton results which is difficult to burn in the time available.

Acceleration which temperature imparts to chemical processes ensures self-ignition at the right time. But what helped to bring about ignition is undesirable in the subsequent phases of reaction. Swift disintegration breaks down the fuel, placing the most sluggish reaction at the end of combustion. So far, the Meurer report has pointed out the various detriments in obtaining complete fuel burning in conventional diesels without knocking and exhaust smoke.

MAN's New Theory

Now let us discuss the new combustion theory as utilized in the MAN system. To more easily understand this

new combustion theory, several observations are cited. If gas oil is mixed with air at low temperature prior to combustion as in a blow torch, the flame spectrum shows bands in the ultra-violet range. This indicates that oxidation proceeds via CH, C_2 and OH, and only later does a continuous spectrum develop showing presence of carbon monoxide. In the engine, combustion starts with the continuous spectrum indicating broken carbon compounds.

While the blow torch operates without smoke, combustion in the engine tends to form soot. For complete combustion, fuel and oxygen should be heated together or at least provision made for starting oxidation gradually. Attention is called to another observation.

In 1908, a theory by Rieppel stated that a little heat causes diesel fuels to form vapors, and it is these vapors that burn in the engine. With an ignition point tester, Wallers and Ehmcke found these vapors have a higher ignition point than the liquid fuel from which they are formed. Also, that the temperature at the end of compression is too low to ignite them.

Evidently ignition point is influenced by mixture formation, being low for vapors formed by heating fuel droplets with hot air, and high for those formed by heating fuel with insufficient air. This is confirmed in the M-engine, where it has been put to good use.

According to Dr. Meurer, combustion noise, and exhaust smoke which develop before excess air is used up, are eliminated in the M-combustion system. This is accomplished if the following requirements are fulfilled.

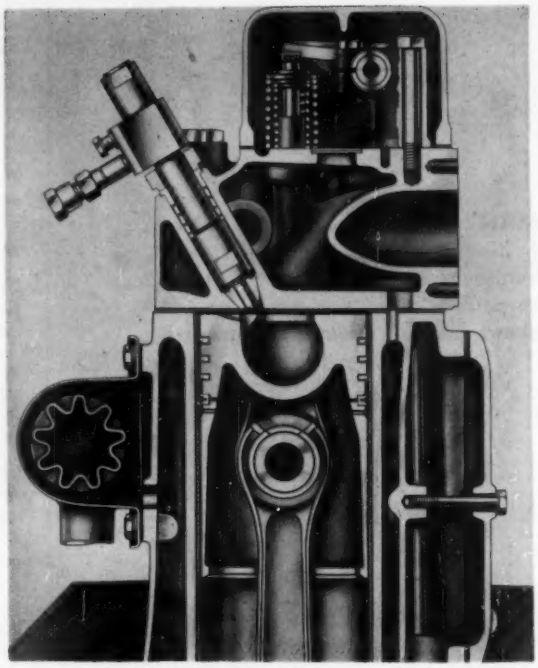
1. *Limit to a minimum the fuel involved in auto-ignition.*

2. *Allow fuel to oxidize gradually and heat fuel and air together.*

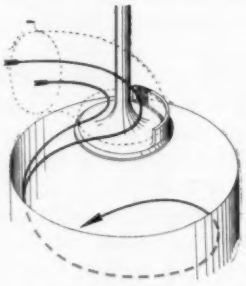
3. *Mix fuel with hot air fast enough to effect a stoichiometric air-fuel ratio before ignition starts and make sure that no more fuel is mixed at any time than can burn with a permissable pressure rise.*

Dr. Meurer asserts that these requirements cannot be met with conventional methods of mixture formation. Relative to requirement No. 2, fuel must not be allowed to contact air in the first stage and therefore must not be atomized. But as it is to be burned eventually, it must be kept in a non-atomized form and at a temperature where gradual pre-oxidation and progressive mixture is possible according to requirement No. 3. The most suitable spot for this is the combustion chamber surface, the temperature of which can be controlled and is sufficiently below that of the gas to protect the fuel from rapid heating. So at the beginning of mixture formation a process is adopted whose retarding effect on reaction is well known and dreaded: *Fuel impingement on the wall.*

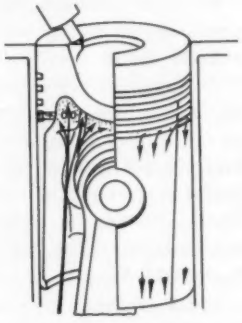
The need for simultaneous cooling and evaporation implied by requirement No. 2, is best met by spreading a thin fuel film over a maximum area of the combustion chamber. It must be thin enough to make cooling effective through the film to prevent the top surface from heating too fast. Therefore, fuel particles are partly exposed to the oxidizing effect and partly to the cooling effect of the wall.



Half sphere M-combustion chamber in center of piston crown has fuel injected against walls in two splashes at 5-deg angle.



Masked intake valves induce rotary air motion.



Directed lube oil jet cools piston cavity from below.

Without rapid mixing with air the results of depositing fuel on the wall would be negative. Since the diffusion rate of vapor which develops on the wall is too low to ensure mixing at the necessary high rate, the air available could not be completely used and fuel consumption would be high. *To peel off the fuel film in layers, a rotary air motion around the cylinder axis is most suited.*

If fuel and air move in the same direction the air will help to spread the fuel film. The nozzle tip is not directly exposed to the rotary air motion. Clearance between the tip and the wall enables fine fuel particles to separate before hitting the wall. In this way the small portion of fuel is obtained which alone, according to requirement No. 1 should self-ignite. To achieve self-ignition of this portion, advantage is taken of the low ignition point of fuel fog formed in the presence of oxygen.

No	Fuel	Specific Gravity °API	Boiling Range °F	% Residues + Evaporation Loss	Heating Value LHV / hp hr	H %	C %	S %	Cetane No	1900 RPM psi	lbs/BHP/hr Sm = 60%	Optim	55.5	1400 RPM psi	lbs/BHP/hr Sm = 60%	Optim	55.5	1000 RPM psi	lbs/BHP/hr Sm = 60%	Optim	55.5
1	Commercial Diesel Fuel	38.3	372 / 680	1.5	1.001	13.03	86.01	0.72		113.8	.389	.381	.455	118.0	.379	.367	.464	118.8	.378	.363	.434
2	Gasoil 428 - 644 °F	38.0	414 / 644		0.9935	12.38	86.89	0.59		118.8	.401	.372	.459	121.0	.381	.372	.452	118.8	.383	.369	.436
3	Gasoil 392 - 572 °F	39.0	399 / 563		0.998	12.99	86.56	0.39	54	113.6	.383	.372	.452	121.0	.376	.367	.430	113.9	.376	.363	.430
4	Diesel Fuel Imported from Austria	33.4	399 / 698	4.5	1.002	13.27	86.68	0.08	52	100.8	.387	.385	.466	119.5	.385	.374	.461	113.9	.385	.378	.443
5	Special Wide Range Diesel Fuel 104-752°F	39.0	104 / 745	2.5	0.982	13.30	86.16	0.66	41	108.0	.385	.380	.463	114.8	.374	.365	.450	113.1	.376	.367	.434
6	Cracked Diesel Fuel	26.5	412 / 597	1.0	0.968	10.93	87.14	2.07	~25	110.2	.389	.385	.488	120.3	.385	.372	.461	120.3	.394	.378	.457
7	Diesel Fuel with High Sulphur Contents	36.0	363 / 662	2.0	1.005	12.34	82.25	5.00	46	111.9	.405	.401		110.3	.385	.383		111.8	.394	.383	
8	Aramco Crude Oil (purified)	34.6	153 / 680		0.994	12.40	84.27	1.63	51	101.7	.405	.398	.481	110.0	.394	.385	.472	(98.1)	.387	.385	.464
9	Mogasoline 80/86	54.5	95 / 392(680)	2.0	1.018	13.70	86.10	0.21	~16	108.1	.362	.354	.423	118.1	.338	.331	.406	123.1	.346	.333	.394
10	JP4	51.5	131 / 549	1.0	1.022			0.16	~35	115.0	.376	.352	.416	118.1	.353	.340	.400	120.9	.367	.349	.397
	max. / min. } Values of Brake Mean Effective Pressure and Specific Fuel Consumption									118.8 / 100.8	.362 / .405	.352 / .401	.416 / .488	121.0 / 110.0	.338 / .394	.331 / .385	.400 / .472	123.1 / 111.8	.346 / .394	.333 / .385	.394 / .464
										+4% / -11%	+12	+14	+17	+3% / -7%	+6	+16	+18	+4% / -7%	+14	+15	+18

Results of burning 10 fuels in M-combustion chamber at different speeds are shown above.

The evaporating fuel particles on the wall consist of cracked products of the first stage that are formed under moderate heat and air deficiency. These ignite spontaneously at a temperature higher than vapor formed in the presence of hot air. Therefore, external ignition and subsequent combustion are possible before the portion of the mixture involved can ignite spontaneously. Incandescent fuel particles generated in the limited auto-ignition provide the means of ignition. This process is repeated in rapid succession in different places. At any one time the process involves only that small mixture fraction which depending on the rate of evaporation passes the ignition limit. All of the foregoing is well confirmed by the M-engine in operation. Now for the design of the M-combustion chamber.

M-System Combustion Chamber Design

It is about a half a sphere, located in the center of the piston crown. The nozzle has two 0.015" orifices. Operating pressure is 2500 psi. Rotary air motion induced by masked valves during suction stroke is increased when forced into combustion chamber as piston nears TDC. Fuel is applied to the wall of the combustion chamber in two splashes at approximately 5° angle. These flow together assisted by air motion, and form a continuous film which covers over half the chamber surface. At full load this film thickness is 0.6 thousandth of an inch.

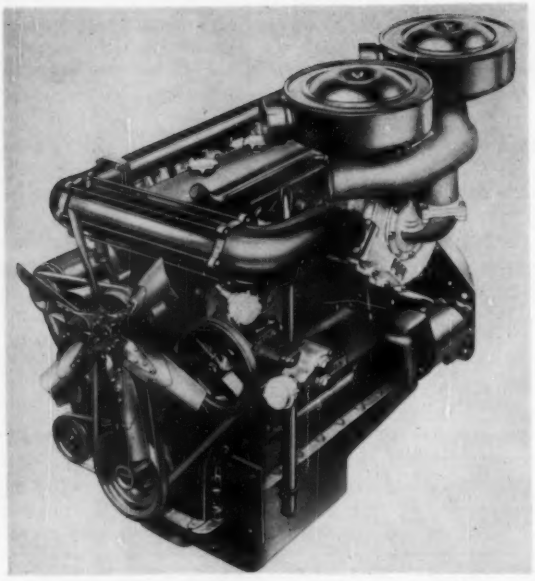
Combustion chamber wall temperature is maintained at about 640°F at full load. A nozzle in the crankcase throws 2.2 quarts of lube oil per minute against the underside of the piston on the combustion side where fuel film is deposited. In this way all pre-requisites for adoption of the described system are fulfilled.

Full Load - Endurance Test Run.		
Engine Type	6 = 4.53" × 5.51" 180 HP Direct Injection	6 = 4.53" × 5.51" 210 HP M - System
Hours of Test Run / Equivalent Miles	60 / 2620	60 / 2620
Neutralization Number	0.3 %	0.0 %
Insolubles in Benzene	0.8 %	0.28 %
Specific Sludge Formation	2.3 oz./1000 miles - 100 HP	1.1 oz./1000 miles - 100 HP
Road Test (City Bus Service)		
Engine Type	6 = 4.41" × 5.51" 130 HP Direct Injection	6 = 4.41" × 5.51" 130 HP M-System
Stat Mile	2240	2240
Neutralization Number	0.83%	0.53%
Insolubles in Benzene	1.9%	1%
Specific Sludge Formation	6.0 oz./1000 miles - 100 HP	3.1 oz./1000 miles - 100 HP

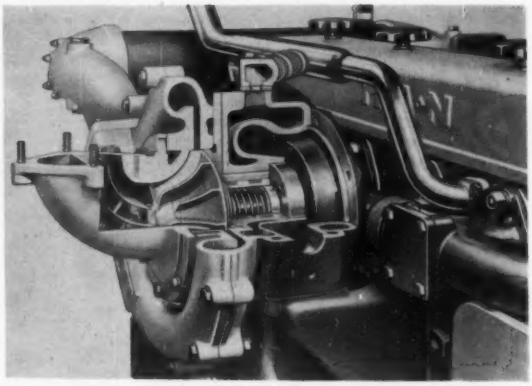
Lube oil in M-System engines shows less contamination than oil in standard diesel after same service time indicating clean combustion.

Test Results and Comments.

According to Dr. Meurer, actual engine tests resulted in no knocking over the entire speed range even during idling and cold starting. This was accomplished without sacrifice in output and fuel consumption, and independent of fuel characteristics including cetane number. However, we not only have the inventors word for these test results, others have confirmed his findings.



Above engine proves adaptability of M-System to turbocharging.



Unique method of mounting turbocharger on intake manifold shown.

Dr. P. H. Schweitzer, head of Diesel Research at The Pennsylvania State University, has not only discussed this engine with Dr. Meurer in Germany, but has actually driven two trucks equipped with this engine and examined the engine at the factory. The trucks both had 6-cylinder, 4.4-in, x 5.5-in bore and stroke, 2000 rpm. engines, one naturally aspirated the other turbocharged.

It was confirmed that combustion knock was practically absent even during cold starting and acceleration. Moving the truck uphill on high gear, it kept crawling at 5 mph and the engine refused to stall. The only way it would stall was to drop the rpm below 200. But it would pick up immediately and noiselessly when at the point of stalling the accelerator was pushed down.

Tests made to determine fuel consumption for a 14.6 ton truck showed the following results:

at 31.1 mph.	18.6	miles/gal	or	254	ton miles/gal
at 37.3 "	16.8	"	or	230	"
at 43.5 "	15.0	"	or	204	"
at 46.6 "	13.8	"	or	188	"

Dynamometer tests showed that low-speed torque was increased 15% over previous MAN designs. Also that the turbocharged engine has 160 bmep at 1200 rpm, dropping to 135 bmep at 2000 rpm, all with clear exhaust. The corresponding torques, 520 and 450 ft lbs, are so high that the transmission and rear axle of the truck could not stand it. For this reason the engine output had to be set lower. Fuel consumption on turbocharged engine was 0.35 lb/bhp-hr and for the naturally aspirated engine 0.36 lb/bhp-hr at 1400 rpm and 80 bhp.

The only disadvantages which Dr. Schweitzer could see were that it is more difficult to start than most conventional diesels, and that it smokes when suddenly accelerated, but only for a second. The former is overcome by the use of an improved type flame starter developed by MAN.

Where To Now?

If the reader has the impression that this combustion system may have a profound affect on the automotive diesel field, that impression is shared by well known diesel authorities and engineers. This impression must also be shared by several large manufacturers of high speed diesels in the United States since they are actively investigating this MAN engine.

In the opinion of its inventor, the Meurer combustion chamber is applicable to two-as well as four-cycle engines, with combustion chamber either in the piston or in the cylinder head. However, since air turbulence is essential, some types of engines are excluded. But the arrangement and design of combustion chambers, the methods of obtaining turbulence etc, are not the only problems to be overcome in order to adopt this new chamber design to our engines successfully. There is a wide gap in our knowledge of combustion mechanics which must be filled.

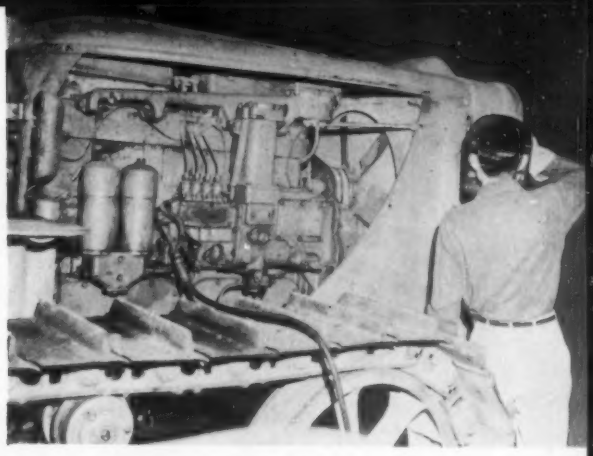
The mechanism of the cracking process and the chemical and physical properties of the intermediate combustion products are largely unknown. With such knowledge, engines and fuels could be designed which would permit us to get more work out of Btu's with less noise, smoke, stink, and wear than we're getting now.

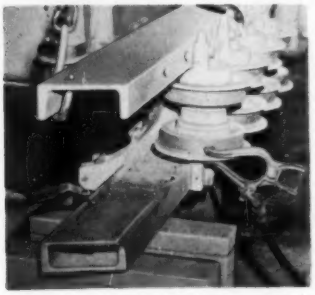
Conclusion

Dr. Meurer's invention is an important turning point in that direction which would be unwise to ignore in any future development. While the M-system engine is already claimed to be a commercial success, Dr. Meurer is the last who would say it is the ultimate and not open to further development. The MAN Company, conscious of the significance of this invention, is prepared to license other manufacturers under the patents covering this invention.

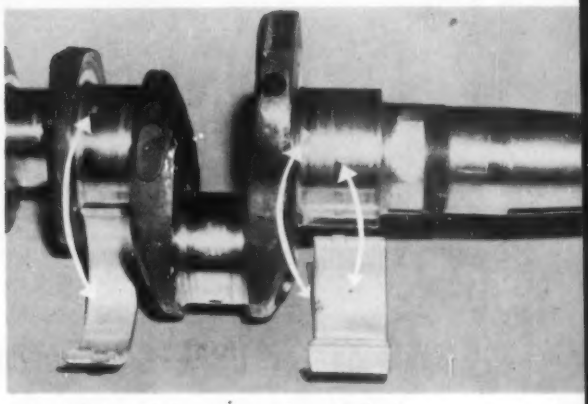
How's Your Ground Connection?

Is welding part of your equipment repairs? If so, improper grounding ruins engine parts.





Welding with ground clamp positioned as shown would leave weld splotches on the bearings in the roller.



Because the ground clamp was not fastened directly to piece being welded, smaller currents set up, jumped bearing gap and formed blotches on journal.

"ARC WELDING" brings a fairly uniform picture to the minds of most of us. Arc welding is accompanied by flashes of blue light and a buzzing, crackling noise. An experienced welder would probably also envision the smooth, even flow of metal as the parts are permanently joined. Aside from the noise and light, what actually occurs when arc welding is performed?

A heavy electric current passes from the arc welding generator through large cables to the metal being welded, jumps across a gap, melts the metal electrode and returns to the generator.

The path of the electric current as it travels from the ground clamp through a tractor, engine or other piece of earthmoving equipment to the point where the arc occurs is of great importance. Remember, an arc and heat occurs wherever a gap interrupts the flow of the current. The heavy welding current may break up and take numerous paths through the machine being welded.

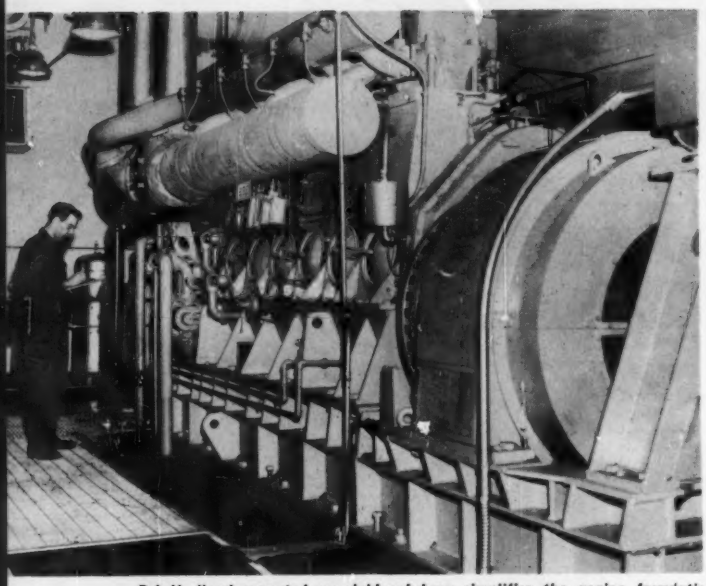
Should one of these smaller currents encounter an air gap across a bearing in an engine, it is possible for miniature arcs and welding to occur right there. Although fusion of the two pieces may not take place, weld blotches on a bearing or gear may cause early failure . . . all because the ground connection of the arc welder was not placed properly.

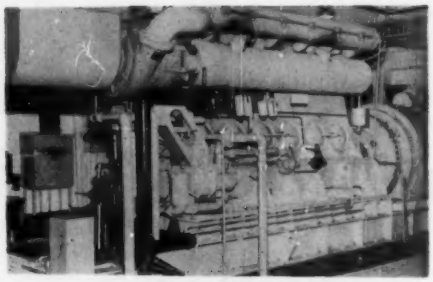
Caterpillar has reports that trace transmission bearing failures and even gear failures directly to weld arcs on the parts. Arcs have been known to occur in a transmission when welding was done on the front end of a tractor!

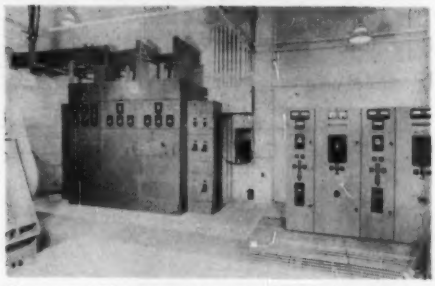
Note the location of the ground clamp in the picture shown. If the welding was done where the mechanic is now chipping off slag, and if the ground clamp was positioned as shown. what about the bearings in that roller? Surely, all the welding current jumped across the gap between the shaft and the bushing in the roller. Did it leave weld splotches? It seems quite likely that it did, doesn't it?

The paths taken by the ground or return current to a welding generator are unpredictable. The only certain thing about electric current is that it will travel the route or routes of least resistance. For this reason, it's always best to fasten a ground clamp directly to the piece being welded.

If this is impractical take a little extra care and clean off paint, rust or oil to give the return current the least chance of going astray. Give the return current a short, direct path and stray currents won't damage other parts of the machine. Next time you are welding something with an arc, ask yourself, "How's my ground connection?"







B-L-H diesel mounted on rigid sub-base simplifies the engine foundations needed at the many USAF communication stations. Metal enclosed switchgear panels contain all necessary metering, control and interconnecting switches for paralleling with outside utility system.

Baldwins for USAF Communication System

Maximum dependability is assured by diesel-generator packaged units installed at USAF communication relay centers. They also overcome complex power problems rising from widespread global network of vital radio stations.

A total of 63 Baldwin engines have been ordered for installation in USAF communications relay centers and transmission facilities. These units will insure continuous electrical power which is the life blood of the USAF Strategic Communication System.

This chain of radio communication stations being installed around the world to serve the Strategic Air Command is so complex that the slightest interruption to the electrical supply at any one major site can seriously upset the entire system. This made it necessary that the Airways & Air Communications Service, Andrews AFB, Md., study every possible source of power from the standpoints of instant "readiness-to-go" and maximum dependability.

The outcome was diesel-electric generation at all of the sites. In some instances diesels will be the only source of power while, in others, they will furnish stand-by protection against local utility outages. The local utility service will be used whenever its characteristics, frequency, etc., are compatible with communication system design. This appears to be possible in only 25% of the installations. Considering the fact that most of the stations, extending like a belt around the globe with tributary stations feeding in at various points, are being located thousands of miles from home base, it is apparent that many problems affect the design of the diesel plants. This work is handled by a central organization for both communications and operating facilities.

One requirement is that plant basic design comply with standard specifications so they would be identical from an operating standpoint. This is necessary because operating personnel is trained in the States before being transferred to the operating site. Every trainee must, therefore, be capable of stepping into any of the plants and carrying out his duties without further instructions.

This requirement added numerous complications to the planning because precautions against climatic conditions had to be worked into the standard design. For instance, it meant incorporating both inside and outside air intakes in each station because the inside intake is needed in extremely cold climates, and in desert areas to protect the engines against dust storms. Similarly, engine radiator fans are equipped with reversible propellers so waste heat can be used for building heating when needed. The

outside air intake uses an oil-bath filter and the one inside is equipped with a dry-type filter.

Station Arrangement

Since all generating plants follow a standard pattern of design, a description of the Andrews AFB in the United States will apply to the others. Each station consists of three facilities or sites, one for reception of messages, a communications relay center and a transmitting site, all widely separated. Andrews AFB is the pattern or pilot station and went into operation late in 1952. Construction of the remaining sites is still progressing along plans formulated after 1949. At Andrews AFB, prime power for operation comes from the local utility with diesel-electric generators on standby for emergency use.

The communications relay center uses two B-L-H-Model 606-A, 6-cyl, 12¾ x 15½-in, 4-cycle, supercharged diesels rated 875 bhp at 514 rpm. The number of diesel generating units in each site varies according to the site load. There is always enough spare capacity to pick up the load if the prime source fails regardless of whether it is utility service or diesel generation. Some sites have only two engines while others have as high as seven.

Each engine drives a 750-kva, 3-phase, 60-cycle, 4160/2400-v generator. The generated voltage is stepped down to 120/208 through service transformers for use in communications.

At this station the utility permits paralleling the diesel generators with its system for picking up the communications load so there is very little chance of appreciable service interruption. In case of an electrical storm the diesels can pick up and carry the load. This also facilitates giving the engine-generators their 4-hr weekly service run without interrupting the power supply even momentarily. Paralleling is done on the low-voltage side and reverse power relays prevent interchange of power into the utility system.

Time-overcurrent relays protect against faults on the utility feeder, and no-voltage relays cut the feeder out if utility voltage fails. Current balance relays protect against unbalanced currents in excess of 25%. The diesel generating units can be started and ready to carry load in 45 seconds.

Fuel storage at the sites is usually enough for 45 days operation. At Andrews AFB storage consists of two 25,000-gal tanks. From these, fuel is pumped to 150-gal day tanks at each engine. The fuel used, which is purchased to government specifications, is comparable to #2-D oil. All oil is passed through a centrifuge before delivery to the engines.

Engine cooling is taken care of through forced-draft radiators fitted with thermostatically-controlled shutters, which maintain engine temperatures at 140 to 160 degrees F. The radiators, with their reversible-blade propeller fans, are installed in one of the outside walls so the waste heat can be exhausted to the atmosphere, or fresh outside air brought in and warmed for building heating and engine intake. Softened make-up water is stored in a 600-gal service tank.

Station control and emergency lighting is served by two 125-v storage battery sets equipped with charging rectifiers. Facilities are installed for centrifuging the engine lube oil continuously or in batches. For the latter method, two 300-gal storage tanks are available.

Operating Personnel a Problem

The manpower pool required to operate the great number of diesel plants in this far-flung undertaking is tremendous. Training the men is an endless job because almost as fast as trainees are added to the pool they disappear in replacing others due for a transfer back to the States or those eligible for discharge from the service. To keep up with the demand for operating personnel as new stations go into operation, numerous schools have been organized to function until the Air Training Command can get its main training center organized.

One of the initial apprentice training schools was conducted by Baldwin at its Philadelphia plant. The course consisted of both lecture sessions and shop work where the students were instructed on the structural design of diesel engines. They also were given adequate training in trouble shooting and operation of the engines and certain auxiliary equipment. After completing its studies at Baldwin, the group went through another course of instruction at the generator manufacturer's plant.

Summary

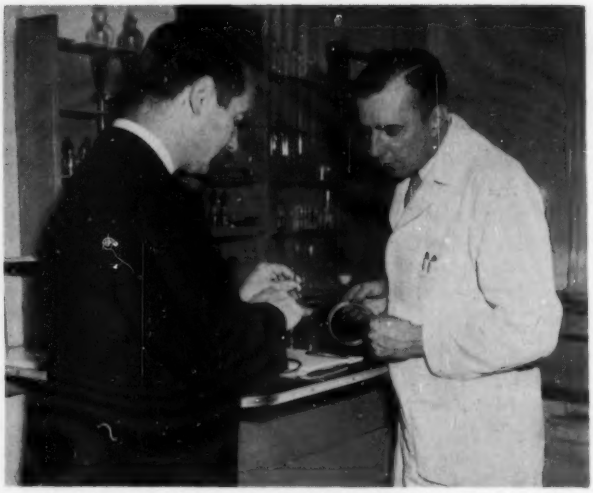
This intensive training of the operating personnel plus the "ready-to-go" service provided by the diesel-electric units has eliminated many of the headaches usually encountered in placing such an involved system into operation. The diesel engines have proven their dependability in every instance, especially in the isolated locations where a breakdown might delay communications for days.

Principle Equipment at Andrews AFB

Diesel Engines	Baldwin-Lima-Hamilton Corp.
Generators	Westinghouse Electric Corp.
Switchboard	Westinghouse Electric Corp.
Supercharger	Elliott Company
Governors	Woodward Governor Co.
Exhaust Silencers	Maxim
Air Filters	Air-Maze
Station Emergency Battery	Exide
Fuel System	
Strainers & Filters	Commercial Filter Co.
Service Pump	Walter Eagen
Centrifuge	Sharples
Lube Oil System	
Filters	The Hilliard Corp.
Coolers	Ross
Tank Level Indicators	Liquidometer Corp.
Engine Cooling Radiators	Young Radiator Co.
Starting Air Compressors	Gardner-Denver
Water Softener	The Permutit Company
Control & Alarm Devices	Fulton-Sylphon
Pyrometers	Alnor
Voltage Regulators	Westinghouse Electric Co.

Save the Engine, Not the Oil

By *Joseph J. Fahey, PMS, Inc.*



Comparing physical evidence of a breakdown with lube oil analysis data.

Following up our series on lube oil and filter change practices, we asked Mr. Fahey, General Manager of PMS, Inc. to comment. His firm contracts with fleet operators to improve their overall engine maintenance by periodic analysis of the lube oil. His long experience in this field has produced some provocative ideas of value to every engine operator. You'll benefit—*Editor.*

STRETCHING the life of lube oil and filter elements is not only possible but practical. The primary objective, though, should be not to save the oil but *to save the engine*. We use our system of lube oil and fuel analysis as a preventive maintenance tool to maintain good engine efficiency and lengthen the engine's life. The fact that lube oil and filter life are also increased is incidental—a welcome cost saving, but still incidental.

Getting the best engine life at high average efficiency is the major goal. Maximum savings are possible here. We analyze the oil because all of the factors affecting engine life and efficiency show up in one form or another in the lube oil. Then if we pinpoint and correct the trouble causing the contamination, we're saving the engine and lube oil and filter elements.

Optimum oil drain and filter servicing periods can be properly established for a given engine or fleet of engines but this does not mean that they are the best for some other operation. Each operation must be evaluated separately on the basis of the factors influencing the degree of contamination of the lube oil. These are: (1) Operating conditions; (2) maintenance and engine condition; (3) fuel suitability; and (4) engine design.

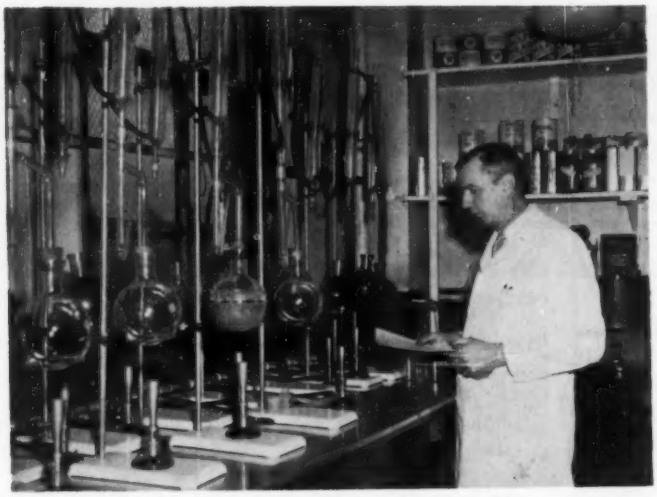
Alone or in combination, these items result in two broad types of contaminants: those formed within the engine; and those introduced from without. The latter generally consists of dirt and sand particles entering with the intake air and/or through the crankcase breather. Water leaking to the lube oil system can also be considered as an external contaminant.

Elimination of these sources of contamination is just a matter of applying good maintenance principles. Good air filters should be used and serviced regularly. The same goes for crankcase breathers. Also look for manifold leaks. Water leaks are a matter of proper fits and gasketing.

Internally-formed contaminants are most troublesome. Diesel fuels are comparatively heavy and non-volatile, requiring near-perfect conditions to obtain satisfactory combustion. Anything about the engine or the fuel that interferes with the combustion process results in unusual amounts of incomplete combustion byproducts.

Besides contaminating the lubricant and perhaps of greater importance, these increased byproducts signify that (a) fuel is being wasted and (b) that early engine failure is inevitable unless the offending condition is corrected. We have seen cases where this rate of "waste" has represented as much as 16.5% of total fuel cost. At maximum efficiency this "waste" figure should represent only approximately 0.005%.

There is a "normal" buildup of contaminants in lube oil in any engine since all the pertinent conditions are never ideal. It is the departure from this norm that is of major significance. It is important to understand, however, that the "norm" will vary from one engine make to another.



ASTM distillation test to accurately determine percentage of fuel oil dilution.

Open cup test to determine flash point.

Differences in combustion chamber design, arrangement of cooling passages, provisions for crankcase and valve chamber ventilation, etc., will affect the rate of producing lube oil contaminants. This is why one engine is known as "dirty" or "hard on oil" when compared to another make. Engine designers are continually improving these factors and narrowing the differences. Actually, design factors account for a good deal less contamination than the other items mentioned earlier.

What are the Contaminants?

In our analysis work we consider all of the normal contaminants—dilution, water, metal, gum, soot, abrasives, etc. Abnormal buildup in one or a combination of these indices is a clue to a specific type of engine malfunctioning. Contaminants and their sources will be discussed.

Deposition and Dispersion Numbers are our way of grouping and measuring all the organic and inorganic contaminants—gums, soot, fuel residues, sludges, etc.—that contribute to deposits. In general, they are the products of incomplete combustion and oil oxidation. We differentiate between the two in this way. The Deposition Number (corresponding generally to the precipitation number measuring the naptha insoluables) is a measure of the contaminants of sufficient density to deposit right now. The Dispersion Number measures the finer contaminants in mechanical or colloidal suspension (benzine insoluables) that are likely to deposit when quantities are abnormal and/or when in contact with a coagulant. A rapid buildup of these contaminants is the first indication of faulty filtration.

When either type of contaminant has built up to critical level, the lube oil must be changed and generally the filter is serviced.

Fuel dilution and soot, for example, are typical products of incomplete combustion. (Very high dilution would probably indicate a leak). You would check the fuel injection system, the air intake system for obstructions, compression pressures, and the exhaust system for restrictions. You'd check your engine operating temperatures and take into account whether excessive loading or idling had occurred.

Gums are products of fuel and/or oil deterioration resulting from improper combustion, very high temperatures, and improper scavenging. They slow up oil flow and are a vital factor in the formation of deposits. Their presence would lead to a check of crankcase ventilation and lube oil circulation.

Carbon is the end-result of the thermal destruction of lube oil. It is the final stage in the whole process of oil deterioration. Carbon granules, particularly in the ring belt area, cause abrasive wear. Transformation of sludge, gum, varnish, etc., to hard carbon is accelerated by abnormally high temperatures as might occur with engine overloading, improper cooling, inadequate lubricant circulation, improper injection timing.

Water and Emulsions result from cooling system leaks direct induction and condensation. Either in the free state or in emulsion form, water has sludge-forming tendencies and should be avoided. Leaks into the system are mechanical in nature and can be corrected. Condensation may be due to low crankcase temperatures, low general engine temperatures as a result of low loads, prolonged idling, or over-cooling, or poor crankcase ventilation.

Metals and Abrasives are principally harmful as agents contributing to wear. The former are generally wear metals, ferrous particles being from rings, liners, etc., and the non-ferrous particles being from bushings and bearings, etc. Dirt and sand particles entering with the intake air will generally contribute to the ferrous type of wear and can be corrected by rigid maintenance of air filters and breathers. If the bearing materials are found,

VEHICLE NUMBER:			SAMPLE TAKEN:						ENGINE CONSUMPTION		FUEL		OIL	
DILUTION	DEPOSITION NUMBER	DISPERSION NUMBER	OPERATING VISCOSITY	METAL	WATER	GUMS	SOOT	ABRASIVES	SPECIAL VIS @ 210°F.	WEIGHT OF OIL	PERIOD (MILES) USED	OIL (HRS.)	SPEEDOM READING	TESTING INTERVAL
			SECONDS						SECONDS					

NOTES:

A B C D E F G H
○ ○ ○ ○ ○ ○ ○ ○

REFER TO ITEMS MARKED (X) ON REVERSE SIDE OF REPORT

REPORT DATE

REPORT SERIAL

Form used by PMS, Inc., to report findings. Letters A to H correspond to contaminants and when critical amounts are found, the appropriate circle is marked. Causes and corrective action are shown on reverse side of form.

some might be due to abrasive particles but also check for irregularities in the lube oil system.

These are the things that we test for and from which we can predict the probable *basic* source of trouble. It is significant that all of these factors that tend to shorten lube oil and filter life are either operational conditions or engine conditions that are abnormal. With proper operation and good maintenance *which you should have anyway*, you not only get greater engine efficiency and life but you also safely extend the lube oil and filter life.

Maintenance vs. Wear Rates

Arbitrary extension of lube oil life may appear to be a good solution. You're saving money and you can't see any harmful results. Yet! One of the booby traps in this business is the long time lag between cause and effect. It takes time for operational or engine deficiencies to contaminate the oil and for the contaminants to do damage to the engine. However, long-term studies show that the chain of events exists.

To illustrate, we have been accumulating data concerning some 5000 diesels of various makes and in over 40 different operations. We have kept track of the progress made since the inception of our service. Each engine was analyzed on a 30-day average basis with additional fuel and lube oil analyses as required.

A summary of the results shows factual evidence of the affect of incomplete-combustion byproducts on engine wear and lube oil contamination rates. The first summary represents the conditions in the engines as PMS, Inc., first experienced them. The first column is self-explanatory. The second column refers to the percentages of the total number of engines in which the quantity of wear metal found was above our "normal" standards for the engine and operating circumstances involved. The second figure is the average metal weight per sample. The same is true in the "Silica" column.

The final column represents the average miles between oil changes (or the equivalent time period) reported by the operators when the service was started. For comparison, the same figure was used in the later compilation.

Even partial correction of the conditions contributing to incomplete combustion cut the percentage of the byproducts in half. Similarly, wear metal and silica which both have an important effect on engine wear rates were substantially cut both as to the incidence of occurrence and the average amounts found. Comparable time increases between overhauls were obtained. Where records permit a check, improvement in fuel economy is also confirmed.

Byproducts of Incomplete Comb. Aver.	Abnormal Wear Metal	Silica (Sand dirt, etc.)	Oil Drain & Filter Change 2200 miles
% of Sample			
13.5%	40.4%	26.5%	63.0%
	3.4 mg	4.7 mg	
(After partial correction of conditions reported)			
6.3%	19.5%	10.8%	21.0%
	2.1 mg	3.2 mg	

Note the great improvement in oil condition. It shows that 42% more of the engines can now go safely beyond the 2200 mile mark without harmful effect on the engines. This clearly points the way toward extended lube oil and filter life.

Suit Fuel to the Job

I've mentioned that all engines have a "normal" rate of contamination buildup. One factor that will affect this norm is the suitability of the fuel characteristics for the particular type of service. In many respects this will establish the norm from which the variation can be noted.

Considering fuel qualities mainly from the possible effect on lube oil contamination (which, of course, has a profound effect on the engine) we are interested in its boiling range or volatility. More specifically, we are interested in the end-point temperature of its distillation range.

All engine builders specify or will give you the recommended temperature limit of the fuel's end-point for different engines and different services. For instance open combustion chamber engines require a more volatile fuel (lower-end-point) than do engines with precombustion chambers. In intermittant service (frequent stops and starts) or where loads fluctuate widely, a more volatile fuel than can be tolerated at full-throttle operations is needed.

Apparently partial loads and lower speeds with their reduced combustion chamber temperatures make it more difficult to get total fuel vaporization. Where full loads and high speeds are normal operation, the higher combustion area temperatures can completely vaporize the fuel.

With high-speed diesels operating in so many different types of service, fuel specifications should be checked to permit selection of one with an end point suitable for the service involved. Distillation ranges of available fuels

will vary across the country with refinery practices and also with the seasons. They all fall within the broad ASTM tentative specification, in fact, commercial specifications are much closer and provide better fuels. Typical distillation ranges are given below.

Diesel Fuel #	I.B.P.	10%	90%	End Pt.
1-D	330-375	400-430	540-570	590-635
2-D	350-395	400-450	620-670	670-725

No. 1-D fuels are intended for engines in services with frequent speed and load changes. No. 2-D fuel is for engines in industrial and heavy duty mobile service. Proper selection between the two categories is most important. Selection within each category can also be important. Should an operation require a distillation end point of 590°F it cannot expect to burn efficiently a fuel with an end point of 635°F even though both are in the same general fuel classification.

On the other hand, if the operation is such that the heavier, less volatile fuel can be used, use it in order to take advantage of the higher Btu content and the attendant economies. However, bear in mind during the process of selecting fuels that the oil companies can and will give you anything that you want but expect to pay for any special products. In most cases the best solution is to select the most suitable fuel from those that are commonly available at standard prices. Premium costs for fuel must be weighed carefully against operational improvements and maintenance savings.

In Summary

Let's tie up some of these ideas now. First of all, let's keep the target in the sights; it's to save the engine, not the oil. Remember, too, that what you do today may not show up in the balance sheet for six months to a year. So don't kid yourself; be sure you know what you are doing before you try to extend lube oil and filter life.

Every engine has a "normal" rate of contaminant build-up. Operating conditions, the quality of maintenance and the suitability of the fuel will all affect this rate. It is up to you to try to avoid the extremes in operation, (low, intermittent loading or overloads), maintain the engine and its accessories in the best possible condition, and to select the most suitable fuel for your operation.

When you have done your best in all these things, you have the lowest rate of lube oil contaminant buildup for your particular operation. Then you are in a position to start evaluating your lube oil to determine how far you can safely extend the oil's life and filter servicing periods. There are many ways of getting this done, including our service.

The big point is that if you do all the things necessary to cut the rate of the oil contamination to the bone, you're going to save so much in better operation, reduction in fuel waste, and lower maintenance costs, you'll wonder why you ever worried about the lube oil and filters at all. And you'll save on them too.

Progress in Truck Noise Problem

A major step toward solution of the noisy truck muffler problem has been accomplished with the adoption of a voluntary low-noise standard by truck manufacturers and operators. The result has been that muffler noise is now less than half of that formerly found. Lewis C. Kibbee, chief of the equipment and operations section of the American Trucking Associations, reported the achievement in an address to the Society of Automotive Engineers.

"Virtually all the new trucks coming off the assembly lines now have mufflers at least as quiet as this standard," Mr. Kibbee stated, "And the replacement muffler people are fast tooling up to produce replacement mufflers for older vehicles that will likewise meet this standard."

Volume of truck noise now acceptable has been limited to 125 sones, the sone being a measure of atmospheric pressure caused by noise plus frequency and other factors such as mixed tones which make noises of equal air pressure level sound louder or softer to the human ear. The old method of measuring sound by decibels gave only atmospheric pressure or intensity of tone. Official acceptance of the sone as the best method of noise measurement was first made by the Automobile Manufacturers Association in March 1954. Adoption of the 125-sone standard followed Armour Institute studies sponsored by the ATA.

The new program of noise abatement is stimulating a big market in muffler replacement. The swing is to larger mufflers with improved silencing ability. Replacement people are taking a closer look at the exhaust system, and doing some needed reevaluation.

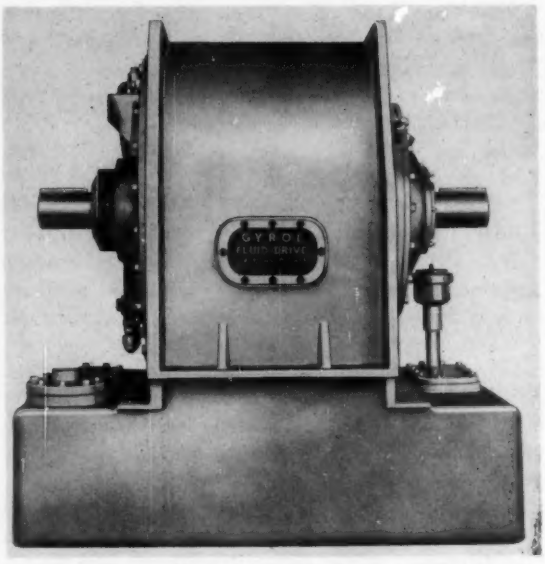
Mr. Kibbee referred to the extras that truck operators are getting out of the new program. The most important is that in redesigning mufflers, manufacturers now have to be careful to include other advances along with making them quieter. "Almost all of the quieter mufflers I have seen," he said, "are more sturdily built to prevent the insides from burning out due to long hours of use at maximum output. Better materials have been incorporated . . . and many are advertised to last 100,000 miles in truck operation.

"The old bugaboo of high back pressure seems to have been licked as well. In short, even though these new mufflers may cost somewhat more than the inadequate ones that preceded them, and will almost universally weigh more, you get more for your money due to longer life, reduced back pressure and decreased maintenance, not to mention the prime reason for their adoption—public relations."

Adjustable-Speed Fluid Couplings

. . . provide flexibility, economy in diesel applications. Control of oil level in working circuit regulates output speed.

by Ben Ragland, Manager
Hydraulic Coupling Division
American Blower Corporation



Typical self-contained adjustable-speed fluid coupling is easily installed or removed for cleaning and inspection by the use of flexible connections on input and output shafts.

COMBINING an adjustable-speed fluid coupling with a diesel engine represents the ultimate in flexibility and results in optimum diesel operation. Fluid drive makes it possible to start the engine smoothly from a standstill against the full connected load.

Operators can control the rate of acceleration by adjusting the torque-transmitting capacity of the fluid drive. Output can be regulated over a wide range while input engine speed remains constant, permitting selection of optimum operating rate without danger of stalling the engine. The lower range of output speeds can be substantially extended because the amount of slip in the coupling can be adjusted for best operation at low speeds.

Adjustable-speed fluid couplings provide an easy means of compounding multiple engine drives and are being effectively used for this purpose. This arrangement is particularly well suited to oil field applications; (adjustable-speed fluid drives are commonly referred to as "Gyrols" in oil field work). The quick declutching feature (adjustment to zero vortex) makes an adjustable-speed coupling an excellent clutch. Withdrawal of oil by extending the scoop tube removes the effective power transmission between input and output.

In a compound installation, one engine can be shut down or idle while the other engines carry the load. The idle engine can quickly and easily take up its load-carrying function whenever desirable without the necessity of reconnecting operations. The use of adjustable-speed fluid drives in compounding diesel engines eliminates the danger of one engine assuming an overload. The load to each engine can be regulated through the fluid drive as required. The fluid coupling gives to a diesel engine the flexibility experienced with a steam-powered installation.

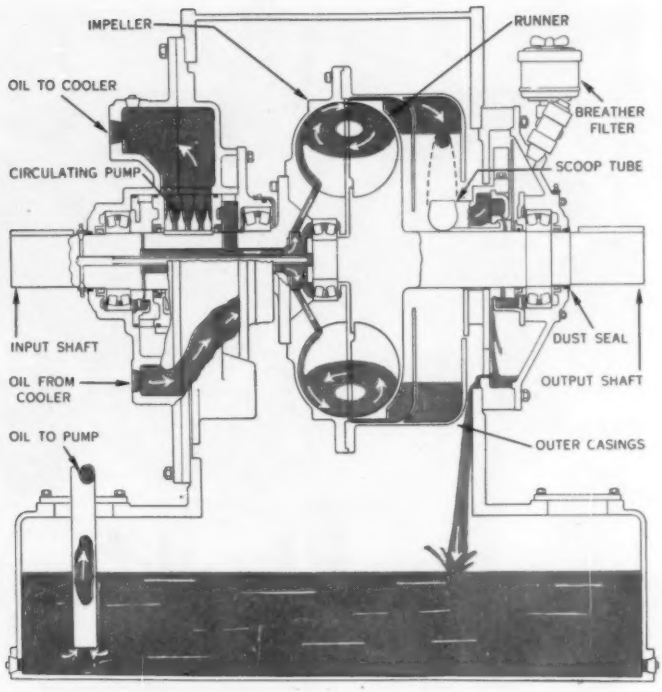
Although fluid drives are used to provide speed adjustment, they do not produce torque multiplication. Input torque is always equal to output torque; the fluid coupling is not a torque converter. For couplings of similar diameter, vortex size and circuit design, torque-transmitting capacity varies as the square of the speed, and horsepower-transmitting capacity varies as the cube of the speed. For couplings of similar circuit design and vortex size rotating at the same speed, horsepower transmitting capacity varies as the fifth power of the diameter.

Stall torque of a fluid coupling represents the maximum torque-load at which the coupling will continue to transmit power for a given fill (vortex size); torque exceeding this value will cause the coupling to slip or stall. Increasing size of the vortex increases the stall torque and, with it, the coupling's input/output efficiency.

During periods where the input-to-output speed differential is great (when vortex is small), excessive heating would result were the adjustable-speed fluid drive to rely on external radiation to cool the oil. Proper oil temperature is maintained by use of a supplementary oil cooler through which the oil is constantly circulated during coupling operation. Air-type or water-type oil coolers can be used.

Construction and Performance

An adjustable-speed fluid drive consists basically of impeller, runner, casing, housing, circulating pump and scoop tube mechanism. The power-transmitting medium is a vortex of oil which hydraulically connects impeller and runner. Size of the vortex in an adjustable-speed



Arrows indicate path of complete oil circuit. Power is transmitted by vortex flow between impeller and runner. Movement of scoop tube toward outer casing reduces centrifugal oil level in circuit and therefore the output speed and horsepower. Movement of the scoop tube toward center of unit increases oil level, speed and horsepower.

coupling can be varied during any cycle of its operation, from no-load to full-load speed on the output shaft. This will vary the output/input speed ratio and control the coupling's acceleration characteristics.

Maximum efficiency in an adjustable-speed fluid coupling under normal operating conditions is in excess of 94%, giving maximum power with a minimum fuel consumption. Since there is no mechanical connection between engine and driven machinery, the oil vortex acts as a cushioning medium. This cushion prevents the transmission of sudden excessive shocks or torsion loads from the engine to the driven machinery or from the machinery to the engine and transmission.

Operation.

The section drawing shows the input shaft, impeller and casings which rotate together at engine speed. The output shaft and runner that rotate together are also seen. Power is smoothly transmitted from the impeller to the runner by a vortex of oil.

Oil level in the working circuit determines output speed and torque-transmitting capacity of the coupling. Pass-over ports between the working circuit and the scoop tube chamber allow a free flow of oil between the two. Thus, there is a common centrifugal level of oil in the working circuit and in the scoop chamber. The scoop tube controls oil level in its chamber and in the working circuit.

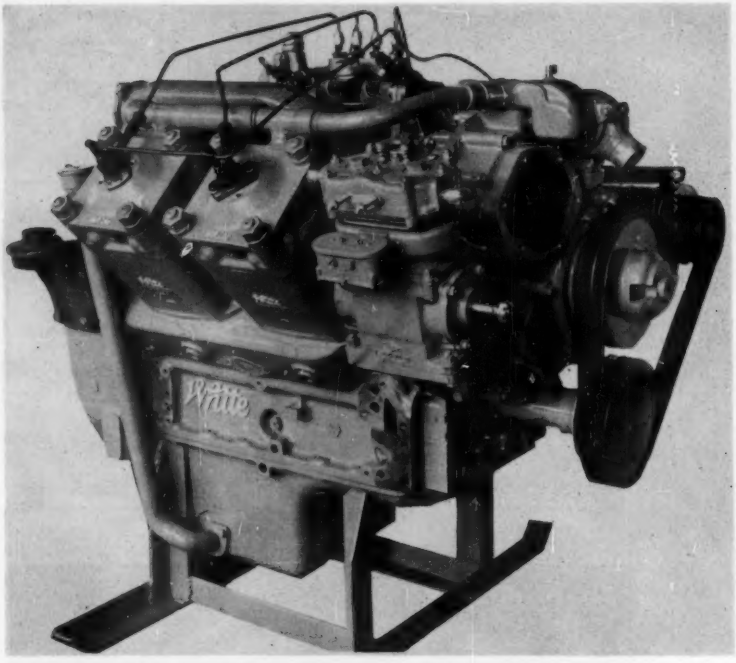
When the scoop tube is extended toward the outer casing, oil level in the circuit is reduced and output speed and horsepower are correspondingly decreased. When the scoop tube is withdrawn toward the center of the unit, the circuit fills with oil and output speed and horsepower are increased. The scoop tube is positioned by a sliding type control mechanism which can be readily adapted to nearly any type of automatic control.

The oil circuit provides the transfer medium for the power, cools the unit, and lubricates the moving parts. The turbine pump, mounted on the input shaft, forces the oil through the pump chamber to an external cooler (not shown in the drawing). Cooled oil is returned to the unit, lubricates the input shaft bearings, and proceeds to the working circuit. From there the oil goes to the scoop tube, lubricates the output shaft bearings, and falls into the reservoir. From the reservoir, it proceeds to the pump and the cycle is repeated.

Installation, Maintenance and Selection

Being self-contained units, fluid couplings are simple to install. The drive is designed for long life with few wearing parts. Maintenance is minimized by having all moving parts continually bathed in the power-transmitting oil. Flexible connections on both input and output shafts permit quick and easy removal of the fluid drive for cleaning and inspection.

Selection and application of fluid couplings should always be checked by the manufacturer's engineering staff prior to installation. Although horsepower and speed are basic factors for adjustable-speed fluid drive selection, it is recommended that information relating to type of load, desired rotation, cooler and control rod location, water temperature (when water is used for cooling), air temperature (when air is used for cooling), and optional auxiliaries also be furnished.



White's V-106 shows air compressor on side of engine, American Bosch injection pump in vee on top of engine and blower, lube oil pump and generator driven from the front of the engine.

White Builds the V-106

White's adoption of the simple loop-scavenging principle for use on their new high speed truck engine is provocative. Results obtained prove that there is more than one way to get power and performance in a small package.

KEEPING step with the march toward greater horsepower without increasing engine size, the White Motor Co. has developed it's looped-scavenged V-106 diesel. To those who favor getting higher-powered engines through higher bmep, it would seem that White has taken a backward step to go forward. But the fact remains that in this V-106 engine, White has produced a 2-cycle, high-speed unit weighing only 6.4 lbs/hp. By the use of loop-scavenging, White has eliminated valves, valve gear and camshaft and with them the assembly problems as well as adjustments and maintenance problems connected with these parts.

Background

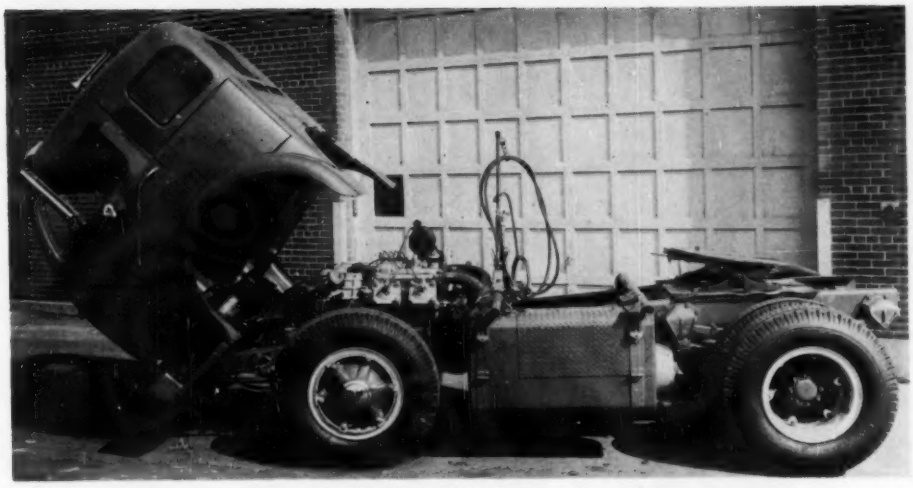
According to a paper presented to the SAE by Messers W. F. Burrows and H. W. Hanners of the White Motor Co., it all started in 1951. At that time White made a survey of truck engine designs of Europe. The objective was to find an engine design that showed good promise with respect to further development in performance and arrangement to meet American requirements. After a thorough investigation, they selected the Krauss-Maffei engine which had been developed by Elwart and Emele, collaborators of Dr. Schnurle, famous for his work with 2-cycle engines and especially reverse loop-scavenging.

Modification of this European engine led to the development of the White V-106 diesel. This engine is now protected by patents as well as exclusive American licenses under the Krauss-Maffei and Schnurle patents.

The original engine which served as a prototype for the V-106, was a 4-cyl, 90-deg vee-type, loop-scavenged, 2-cycle diesel with 4.73 x 5.2-in bore and stroke. It developed 145 continuous horsepower at 2200 rpm. It was 35-in long, 36-in wide and 44-in high, weighing 1579 lbs., or 10.9-lbs/hp. At full-load, full-speed, the fuel consumption was 0.38 lb/bhp-hr. Road fuel consumption measured 291 ton-miles per gallon at 21 mph.

Modifications

The White Motor Company modified this original Krauss-Maffei design to achieve certain specific results. Arrangement and position of several engine components were altered for simplification. Other changes were made to conform to American practices. Engine displacement was increased, producing a corresponding boost in horsepower ratings.



A 4-cyl V-106 proves well adapted in size and shape to fit limited space under cab of a short truck tractor.

Since overall engine dimensions with accessories installed are an important factor in vehicular engines, the length and height, causing the principal mounting interferance, were kept as small as possible. Although the demand is for light weight with increased horsepower, the higher-horsepower engine must still fit in the same or less chassis space. White was able to do this.

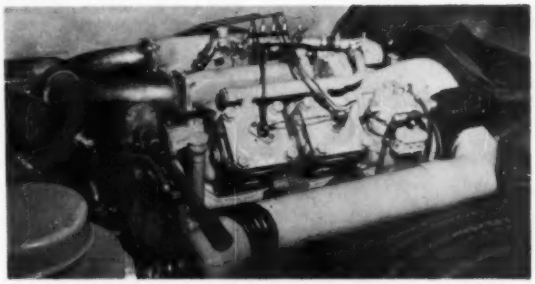
The increasing popularity of the shorter truck tractor design is influenced by legislation covering the total vehicle length. The cab and engine arrangement of the White 3000 series truck allows full advantage to be taken of a compact engine. A two-cycle, vee-type engine such as the V-106, is not only extremely compact, having reduced height, length and weight, but also has a shape adaptable to the available space in a truck chassis.

Other objectives of the modification were that the engine should have low initial cost, good fuel economy and low maintenance costs. Its characteristics had to be such that it would suit other applications since it was not intended solely for use in trucks. The White approach both in selection of an engine type and in the later modification was toward maximum simplicity.

A simplified engine means not only lower cost for the engine in the truck but also lower cost for the spare engines and parts carried in stock. The simpler engines require less repair labor, a large part of maintenance cost, as well as fewer repair parts to stock. White's engine is of the simplest possible type—a loop-scavenged 2-cycle unit.

Scavenging

Modern 2-cycle engines employ either port scavenging or port and valve (uniflow) scavenging. The specific output in terms of cylinder displacement generally favors the uniflow-scavenged engine. Cylinders are more effectively cleared of residual gases and volumetric efficiency is better. With more air in the cylinder, bmep's are generally higher. One school of thought perfers the uniflow



Engine in truck shows air filter lower left, exhaust manifolds, and other parts all of which are accessible without difficulty.

design with its higher bmep's as a means of getting greater output without increasing size.

Yet with this apparent disadvantage, White and others still prefer to employ loop-scavenging. Let's see what makes this system attractive and especially with respect to the V-106 engine.

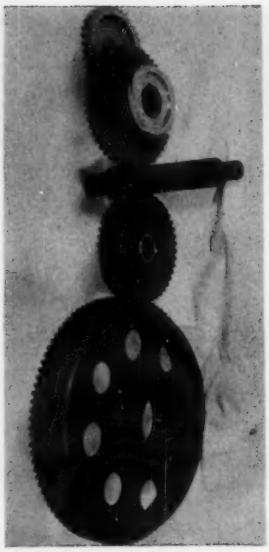
Higher bmep's are only one way to increase horsepower. You can increase rotative speed and you can increase displacement. Both of these methods can be used with the loop-scavenged engine. Rotative speeds of these engines can be somewhat higher because of the absence of valve gear. Also, the space and weight saved by the elimination of camshafts, pushrods rocker arms, valves and covers can be used for added displacement.

The result is that despite the uniflow-scavenged engine's higher cylinder pressures, it is possible to get the same or even greater power from the same package by use of the loop-scavenging principles. It's the power that counts and the operator doesn't care how you get it.

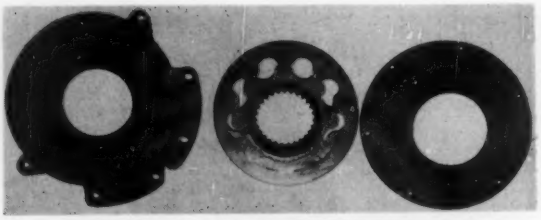
Design and Construction Features

By eliminating all valve gear, the number of moving engine parts were reduced to a minimum. Operationally, this lowers frictional and parasitic losses. From the man-

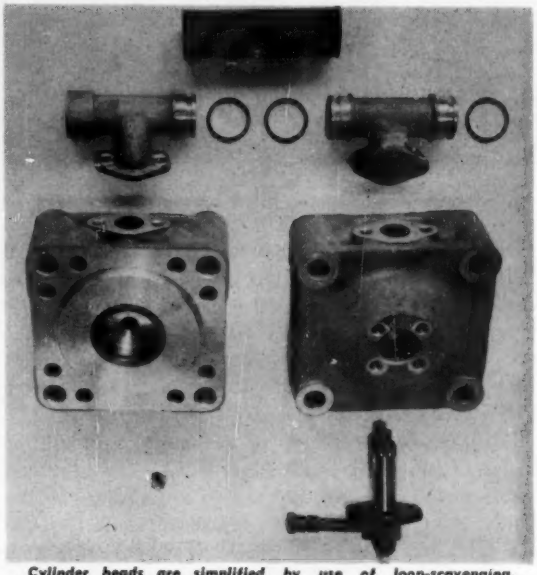
Reciprocating assembly-ductile iron piston, full floating pin, H-beam rod, precision bearing.



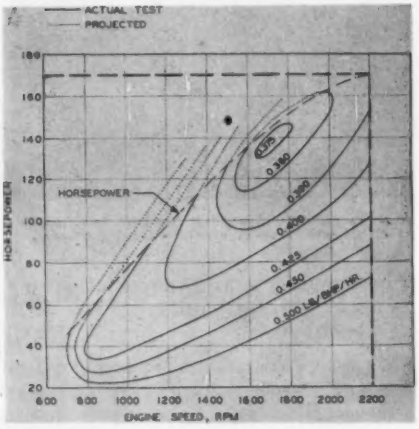
Gear train from crankshaft through blower shaft pinion to the injection pump drive.



Lube oil pump with specially-shaped teeth is driven from the front end of crankshaft by involute spline.



Cylinder heads are simplified by use of loop-scavenging. Elimination of valve gear cuts servicing and reduces cost.



Test fuel consumption curves for the White 4-cyl V-106 show low fuel consumption for all speeds.

ufacturing point of view, it simplifies production and lowers costs. White took advantage of these benefits when they selected a loop-scavenged engine design.

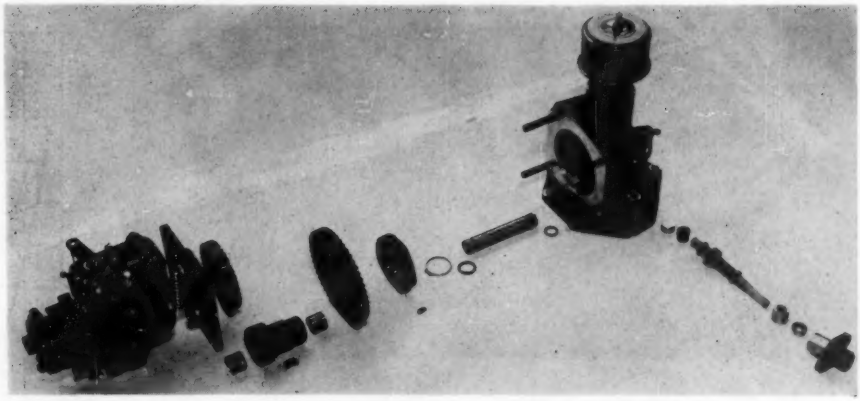
They have modified the original design to produce maximum operational flexibility. Rotative speeds were held at 2200 rpm which gives a moderate piston speed of 1879 fpm. Displacement was boosted to 106 cu in by going to a 5⅛-in square engine. The 4-cyl engine is rated 170 bhp at 2200 rpm with a bmep of 72 psi.

The 4-cyl engine weighs 1090 lbs when made of aluminum construction and 1355 lbs when some of the major components are made of cast iron. The 6-cyl engine weighs 1530 lbs for aluminum and 1900 lbs for cast iron construction and has a rating of 255 hp. These weights include all regular accessories except the clutch. An 8-cylinder engine is being considered for future production.

Overall dimensions are as follows:

	4 *cyl.*	6 *cyl.*
Length-Rear of flywheel housing to front of fan	42-7/8″	52-1/2″
Width-Edges of cylinder heads	36-1/2″	36-1/2″
Height—Injection tubing Bosch pump to bottom of drain plug	39-13/16″	39-13/16″

Now for a little information and data about the major parts of the engine. The 3-main bearing crankshaft weighs 155 lbs, has 4-in main journals, 3-in crankpins and an overlap between them of 15/16-in. This considerably stiffens the shaft. The 2-cycle, 90-deg vee-type cyl-



Pump drive is adaptable to Roosa-Master injection pump, above, as well as to American Bosch.

inder arrangement produces an inherently well balanced crankshaft, connecting rod and piston assembly. The crankshaft is counterbalanced for the rotating masses of the crankpin, the large end of the connecting rod and all vertical reciprocating forces.

The crankshaft and connecting rod assembly is completely pressure fed. Oil through rifle-drilled connecting rods lubricates the piston pins and sprays through a jet for piston cooling. Precision bearing shells are used for both main bearings and crankpins with the thrust being taken by thrust washers at the center main bearing.

The crankcase is a single casting which carries the crankshaft and forms part of the air box on which the individual cylinders are mounted. The front end of the crankcase is machined for mounting of the gear train which drives the blower and injection pump. Various drilled holes serve as lubricating oil distribution passages. The water inlet manifolds are cast into the crankcase.

Connecting rods are of the H-beam section design for high strength, and low weight. The piston pin is mounted in spiral groove bushings both in the small end of the rod and in the piston. It is full-floating and retained by plugs mounted in the piston at the ends of the piston pin. The piston is of ductile iron having three compression rings of the keystone type and two oil rings.

Each cylinder is an individual casting with an integral water jacket. Rubber "O" rings seal the water passage joints with the crankcase. The porting arrangement is of the Schnurle system having three exhaust ports flanked by three air inlet ports on each side. All the air inlet ports are directed away from the exhaust ports to displace more effectively the gases and prevent short circuiting of fresh air to the exhaust ports. The exhaust passages from the ports are large, assuring free flow of the gases. These individual cylinders can be replaced without disassembling the connecting rods or removing the oil pan.

The gear train is designed and located to minimize engine length. The crankshaft gear, idler, blower shaft pinion, intermediate gear and the drive gears for the injection pump and tachometer all have hardened teeth.

The blower impeller is of the mixed flow type for best efficiency with low noise level. Air enters the blower at the front of the engine and after passing through the impeller, enters the spiral diffuser from which it flows through the transfer case into the air box in the vee of the cylinder block.

The oil pump is compact, has specially-shaped gear teeth and is driven directly from the front end of the crankshaft by an involute spline. The oil pan carries 14 quarts of oil.

Generously sized exhaust manifolds are designed to minimize exhaust pulse interference and give maximum clearance for the injection system in the vee at the top of the engine.

The water pump is of conventional construction except that it has double outlets, one for each bank of cylinders.

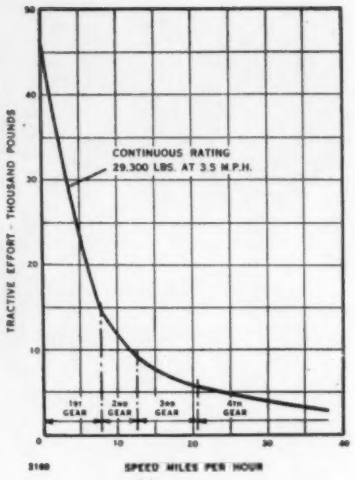
The injection nozzles are of the differential type and the injection pump is either the American Bosch or Roosa-Master design.

Conclusion

The simplicity of White's V-106 is self-evident. The advantages inherent in this type of engine have all been outlined and generally discussed. Use of these advantages to a maximum degree is White's approach to supplying the diesel operator with what he wants—the horsepower he must have in the smallest, lightest package. Plus this he wants low cost, reliability, and ease of servicing. The V-106 is White's answer.

Performance-wise, the engine shows up well. Its horsepower compared to cubage, weight, or in terms of fuel consumed, shows up very well. Optimum fuel consumption occurs in the most-used speed range thus favoring fuel economy on the job. Its tests, both in the laboratory and in extensive field testing, has been very encouraging to White, particularly with respect to some recent comparative road tests.

Adding everything up, it looks like a good bet that this engine's presence will be felt in the trucking field and in those other applications for which it is selected.



Army Gets Diesel-Hydraulic Switcher

Simplicity of operation and maintenance were two prime requisites in the Army's search for a locomotive. These were accomplished by the use of a mechanical-hydraulic drive from the diesel.

AT the acceptance ceremonies for USA-1281, General Paul F. Yount, Chief of Army Transportation said, "I was seeking something that any American boy could handle". He pointed out that in a citizens army, the highly-trained men necessary to maintain diesel-electric units are not available in sufficient numbers.

A reduction in spare parts, and a reduced requirement for critical electrical materials which have been in short supply in past emergencies are other advantages which accrue from use of a hydraulic transmission.

To obtain a locomotive of the required characteristics meant investigation. The Transportation Research and Development Command, of Army Transportation Corps, in 1952 entered into a contract with Baldwin-Lima-Hamilton for necessary investigation, design, and later construction of an experimental prototype locomotive, utilizing a torque converter transmission.

This investigation indicated that the German Maybach "Mekydro" transmission was the best suited service tested hydraulic transmission available.

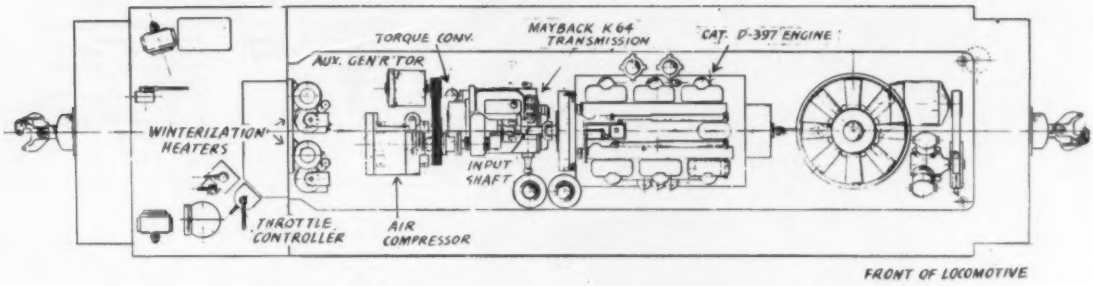
In general, the prototype torque converter locomotive contains the same range of operating features as the Army's 60-ton, 400 hp overseas standard and broad gage diesel-electric locomotive design, such as: Multi-gage wheel spread, ability to operate in ambient temperatures from -40°F. to 125°F extendable to -65°F with use of a winterization kit, multiple unit operation with all of the other military overseas diesel locomotives, provision for foreign coupling arrangements, a very restrictive clearance outline, severe axle load limitations, and provisions for installation of vacuum brake equipment.

Many of the components of the two locomotives are the same or very similar, such as the engine, control equipment, brake equipment, etc. Despite a similarity of appearance and the many interchangeable parts, the torque converter locomotive is 8½ tons lighter than the diesel-electric.

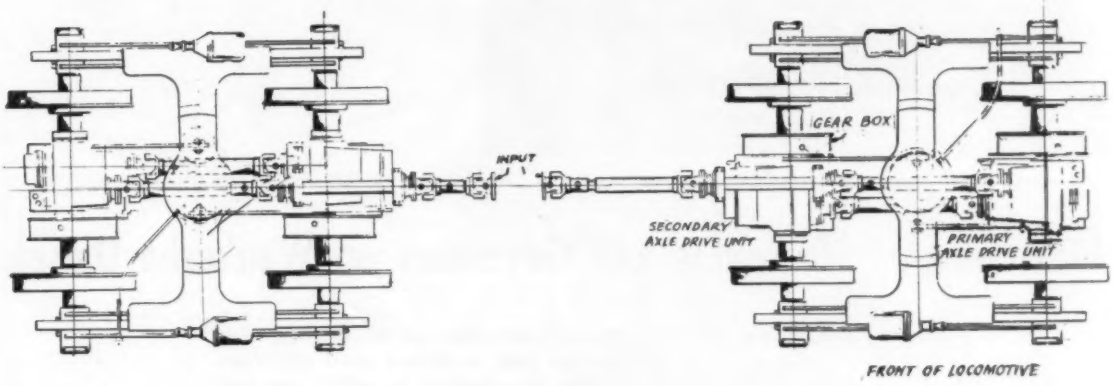
Part of this weight reduction is due to the lighter transmission equipment, and the rest by a concerted effort to eliminate every excess pound of weight in this particular locomotive. To accomplish this fuel tank capacity was reduced from 500 to 350 gal, aluminum is used for the cab, hood, running boards and other parts, the wheels are machined all over, and the four inside sanders are deleted.

Propulsion Assembly

The Caterpillar Model D-397 engine is connected at the fly-wheel by means of an adapter flange to a flexible shaft which delivers power input to the Maybach K-64 torque converter and gear transmission unit.



Plan view of transmission and other locomotive apparatus above and below underframe.



Three solenoids on transmission case are energized by controls in the engineer's cab; one is for forward and one for reverse movement, energized by reverse handle, while the other is controlled by throttle for engaging and disengaging the torque converter. When in engaged position the torque converter turbine is in the hydraulic circuit, and power is transmitted through a series of gears to output couplings (one for each truck) at the bottom of transmission.

Gear selection is automatically controlled by a fly-ball governor, which is a part of the gear assembly.

The feature which makes the Maybach transmission unique in locomotive service is the method by which gears are engaged. Over-running claw clutches permit an entire shift of gears automatically with reapplication of power in about one second.

A series of shafts, universal joints, pillow blocks, couplings, axle drive units, and gear boxes for the final axle drive gearing, transmit power from the hydraulic transmission to the wheels. German practice is to apply torque power to driving axles direct through helical bevel gearing.

In this instance, a new Baldwin-Maybach axle drive unit was developed, using a gear box with output pinion gear which meshes with a large bull gear, similar to a diesel traction motor pinion and ring gear. This arrangement permits the dropping of a pair of wheels out of the axle drive unit, as readily as a pair of wheels can be dropped from a diesel traction motor truck. This could not be done with the Maybach German design, as a disassembly of drive unit and shafts, would be necessary. In this design suspension bearings, which are interchangeable with those of the 60 ton diesel-electric locomotive traction motors, and a torque arm and snubber arrangement which absorbs torque reaction.

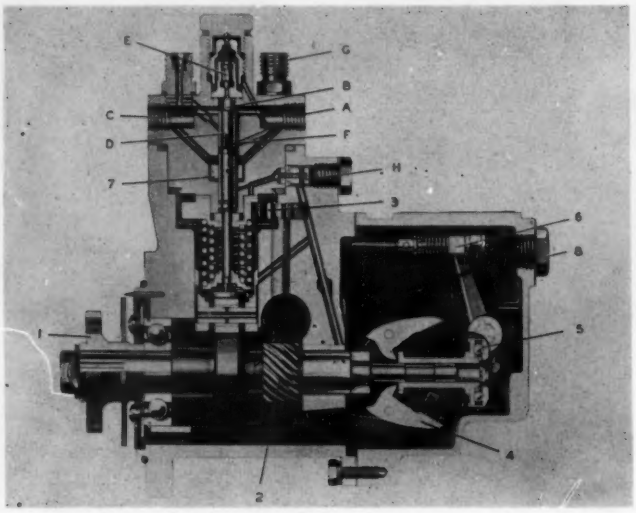
An interesting feature in transmission arrangement between torque converter gear box output and axle drive units (below underframe) is the location of the drive shafts. In order to be able to operate around a 75-ft minimum radius curve, it was necessary to place the primary axle drives on the outside pair of wheels in each truck (i.e. on No. 1 and No. 4 axles). Secondary axle drive units on the two inside pairs of wheels (No. 2 and No. 3) are driven from the primary axle drive units.

A plan view of engine, transmission, auxiliary generator, air compressor and other apparatus above the welded steel underframe, presents about the same arrangement as a diesel-electric with the Mekydro unit taking the place of the main generator.

Batteries are of lead acid type, 32 cell, 280 AH capacity furnish current for the electric starting motors—two in number.

The Caterpillar D-397 engine is rated at 500 hp sea level; at 363 hp at 10,000-ft elevation and 90°F. The locomotive tractive effort, starting, (30% adhesion) is 31,200 lbs., and continuous rating of 29,300 lbs at 3.5 mph.

Many parts, auxiliaries and their characteristics are the same or very similar to diesel-electric units of similar size.



American Bosch PSB Fuel Injection Pump

A—Fuel inlet
B—Space above plunger
C—Return line fitting
D—Plunger
E—Delivery valve
F—Slot in plunger
G—Outlet to nozzle
H—Lube oil filter
1—Variable coupling
2—Spiral gear
3—Gear on vertical shaft
4—Governor weights
5—Pilot
6—Smoke stop screw
7—Sliding collar on plunger
8—Access to smoke stop screw

Maintaining PSB Pumps and Governors on Waukesha Diesels

Procedures for installing, timing, servicing and trouble-shooting on American Bosch PSB pumps and governors used on Waukesha engines. Data can also be adapted to other engines.

SPECIFIC instructions for servicing, installing, timing and/or adjusting fuel injection pumps and governors are a necessity. Unless these pumps and governors are serviced and installed perfectly, not only will the engine operation be adversely affected but actual damage may result. Enough just can't be said to stress the importance of the proper maintenance and the precise adjustments of these units.

Diesel Power herein furnishes a step by step procedure condensed from the Waukesha Motor Co. instruction manual, for working with and on the American Bosch PSB pump and the governors used on Waukesha Model 180, 190, 195 and 135 series diesels. Although this procedure may not specifically apply to your engine it is typical of the methods generally used in the field.

Timing Injection Pump

1. Mount pump and connect fuel inlet and injection lines.

2. Remove engine gear housing timing plug, cover plate on side of pump and coupling to drive gear access plate.

3. Bring up No. 1 piston on compression by turning crankshaft in normal running direction until (FP) mark on flywheel is centered in timing opening in flywheel housing and both valves are closed.

4. Rotate pump until marked gear tooth aligns with ridge on surface of pump casting inside cover plate opening. Pump is now in phase for timing to number 1 cylinder.

5. While looking through pipe plug hole in gear housing, the pump shaft must be turned with a suitable wrench until the timing indicator disc with a small notch in outer edge is exactly under timing pointer on pump face.

6. Install coupling bolts while holding timing disc in perfect alignment.

7. After capscrews are tightened, secure with lock wire. Final timing as done in step 5, will result in movement of the marked gear tooth with respect to the ridge. This should not exceed about 3/16-in, or 1½ teeth.

8. Re-check all marks described in previous steps, then replace covers and plug in timing hole and install other controls and connections as required.

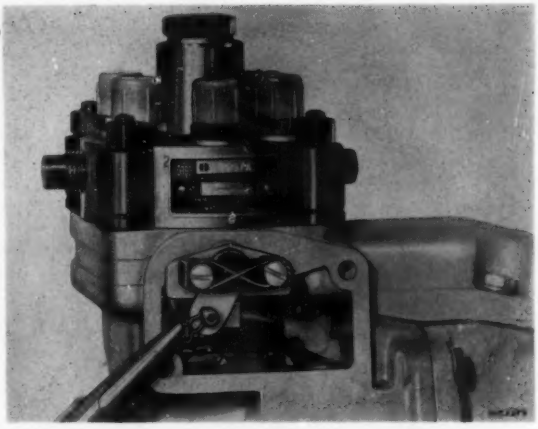
Service Check, Bosch PSB Pump

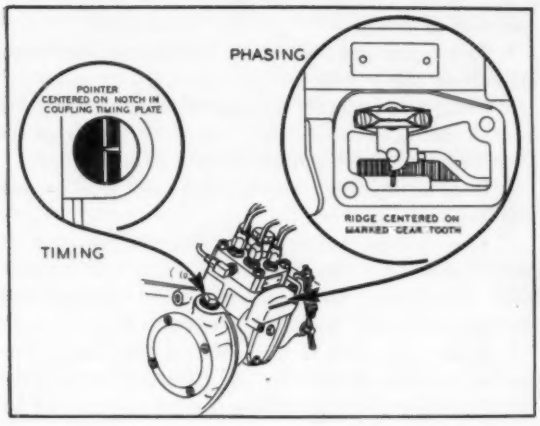
The following is offered as an aid to field personnel who may not be familiar with the easiest methods of making common field checks on Bosch PSB pumps. It applies generally to all PSB pump installations.

Where replacement of the hydraulic pumping head is necessary, this can be done with the pump on the engine. This eliminates the installing and timing of the pump, plus removal of accessories or truck parts offering interference.

The following conditions are typical situations where complete pumps may be removed unnecessarily:—failure to accelerate, decelerate or respond to throttle.

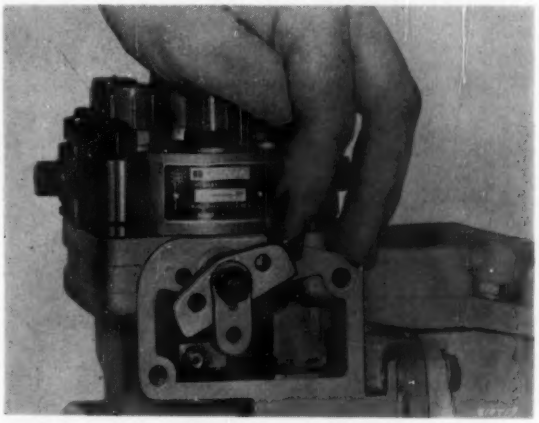
To check for free movement of governor control arm, remove the hairpin clip shown here. The arm should swing freely.

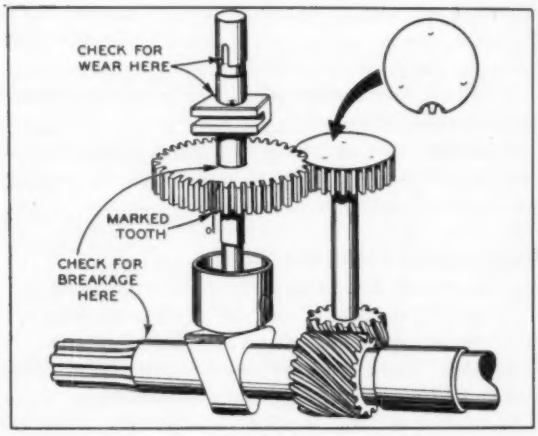




When marked gear tooth aligns with ridge on cover plate opening, pump is in phase for timing on number 1 cylinder. Notch on timing disc should be visible under pointer in plug hole.

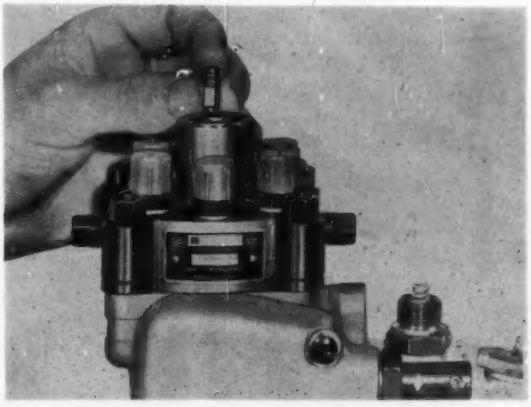
To clean control arm parts, or remove hydraulic head from pump, carefully withdraw arm and tip from head as shown.

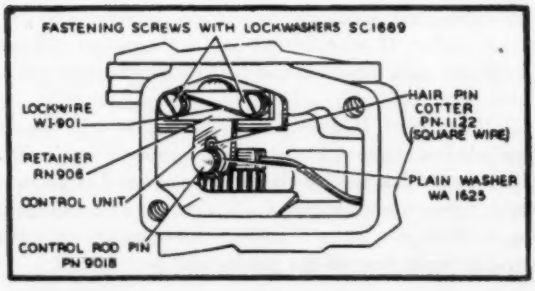




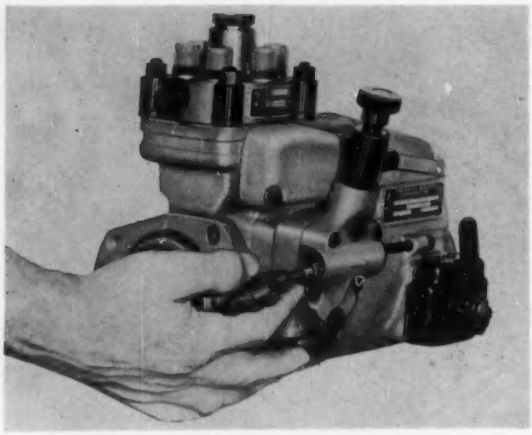
Schematic shows plunger receiving reciprocating motion from cam and rotary motion through spiral gear and vertical shaft.

If delivery valve or spring is corroded, gummed, or sticking, engine may not start. Remove valve and wipe it clean.

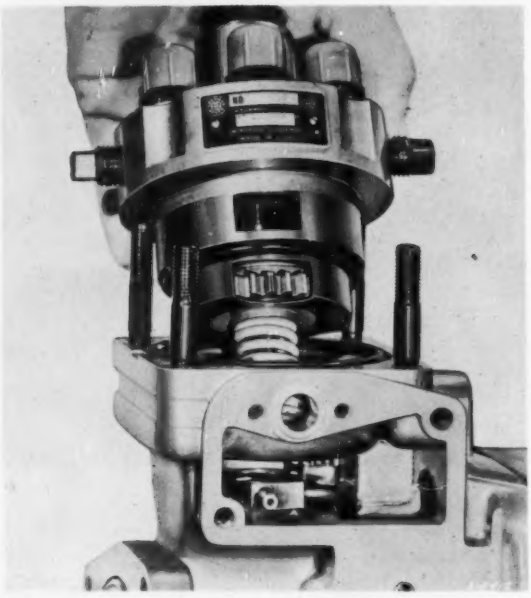




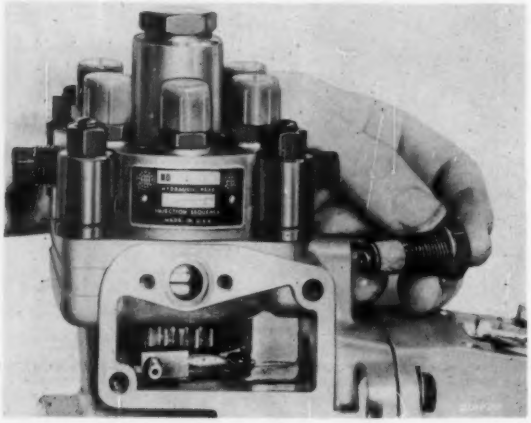
With engine operating and inspection cover removed from side of pump, governor control arm and rod motion can be observed.



Too little fuel or insufficient pressure in hydraulic head causes hard starting. Gum or dirt on relief valve may do it.



With control arm, filter and retaining nuts out, hydraulic head lifts out if marked tooth aligns with casing ridge.



Filter cleaning engine lube oil entering plunger area must be removed to lift head. Seal ring on filter must be good.

The probable or possible cause — improper control sleeve movement.

1. Check for freedom of external throttle control linkage.
2. Remove inspection cover from side of pump.
3. Operate engine and observe movement of control arm to which governor rod links. If it is sticking or its operation is erratic—
4. Stop engine and disconnect governor rod by removing hairpin clip or retainer.
5. Swing arm manually through entire range of movement. It should be free enough to drop of its own weight when swung to either extreme. If arm is sticking—
6. Remove the two retaining screws and retainer and withdraw the control and tip.
7. Remove snap ring and separating the two parts of control arm body, lap pivoting surfaces with mutton tallow only. Repeat lapping as required to produce free precision fit. Never use lapping compound.
8. Re-assemble parts in their original relationship. For ease in replacing control arm and tip assembly, hold the control arm so it is swung into the extreme shut-off or stop position.
9. If steps 1 and 5 show the arm to be free, with governor control rod disconnected, check governor rod movement manually for full travel and smooth operation.
10. If further checking is necessary, remove governor housing and inspect governor parts. Excessive wear, looseness, rusting, pitting or corrosion, especially in the governor sleeve area require cleaning or replacement.
11. Check fulcrum and other pivot points in governor and determine if cocked or binding.

Note that none of the above suggested steps require retiming the pump or removal from the engine provided work area is kept clean.

Engine Stops—Will Not Start:

It is assumed that pump is timed and is receiving sufficient fuel. A solid flow of fuel, visible while cranking with fuel return to the tank disconnected, indicates no air locks. Also, check for intermittent spurts of fuel while cranking with fuel line to injector disconnected.

If no fuel is being injected, the following steps will determine if and where the trouble is within the pump.

1. Remove delivery valve cover nut, valve spring and valve with tweezers or magnet. If delivery valve is sticking, clean with mutton tallow.
2. With clean piece of wire resting on top of plunger, rotate engine. If wire doesn't move, there's no plunger movement indicating broken plunger or sheared pump drive.
3. If quill shaft is turning when looking through inspection window while cranking engine, pump drive is OK. If it isn't turning, quill shaft may be sheared. For positive check, remove transfer pump and if camshaft is not turning at spiral gear where it engages the transfer pump, the pump drive is sheared and pump must be removed.

4. If camshaft is turning but plunger isn't moving vertically, the plunger is broken. Remove hydraulic head and inspect plunger. Hydraulic head is replaced without removing or retiming pump if plunger is broken.

Hydraulic head removing procedure follows:

(a) Clean working area.

(b) Disconnect fuel inlet and outlet lines and interfering accessories, and protect openings.

(c) Remove inspection cover. Remove hairpin retainer and disconnect governor rod. Remove control arm and body.

(d) Remove oil filter below primary fuel inlet line. It is essential to have a good seal between "0" ring on filter and hydraulic head to prevent mixing of lube oil with primary fuel in pump.

(e) Turn engine until marked tooth on pump plunger drive gear is aligned with "O" mark or ridge (on latest pumps) on lower part of cover opening, then remove retaining nuts and lift head.

(f) Align marked booth on new head with ridge or "O" mark as above and drop into place. Re-assemble parts as they were removed. Use two new "O" rings on the two different diameters of the head if possible. If these seals leak, fuel will flow into the oil pan.

(g) Note that one of the brass fittings in the return line leaving the pump is a special bleed orifice. Replacement with a standard fitting results in hard starting and poor operation.

Hard Starting—Poor Performance:

Specks of dirt and corrosion ruin a plunger and barrel assembly within minutes. Such an occurance can't be overlooked even in new pumps. Therefore, if hard starting or poor performance is experienced, check as follows:

1. If camshaft and plunger motion are normal, yet sufficient injection pressure can't be built up by pump, plunger may be worn.

2. To remove plunger, take off hydraulic head, invert and remove lower "0" ring. Force crimped plunger retainer cap loose with screw driver.

3. Lift out plunger, noting control sleeve position with respect to slot. Always replace in same position.

4. Examine plunger. Any scuff marks, scratches, marks in distributor slot area, rounded edges on plunger annulus and control sleeve and rust or corrosion indicate that a new hydraulic head is required.

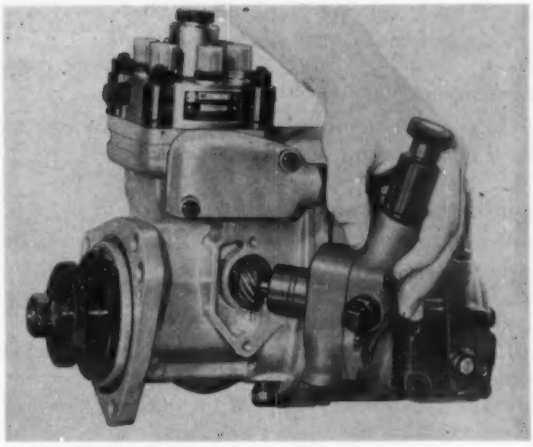
5. If condition of parts are OK re-assemble pump head. To insert plunger in control sleeve:

(a) Invert pump head. Install sleeve with slot facing out towards nameplate side of pump head.

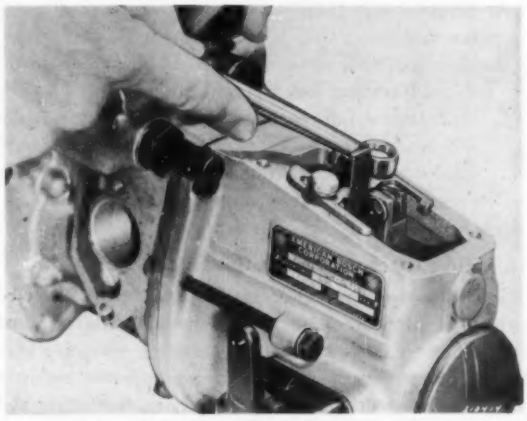
(b) Sight hole in sleeve so it aligns with plunger bore.

(c) Insert plunger and bring it in contact with sleeve. By gentle maneuvering of sleeve, center the sleeve and enter plunger. Don't overlook bronze thrust washer which seats on the drive gear.

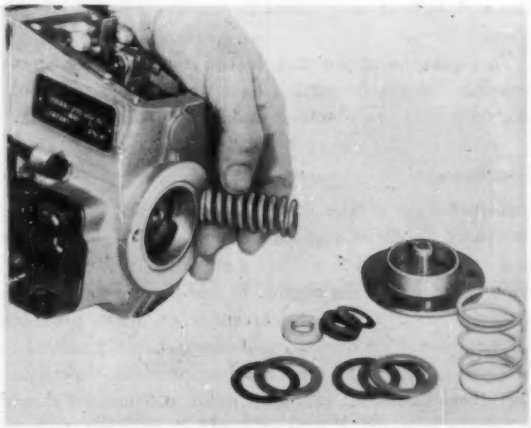
(d) Match dimple in sheet metal cover to recess in lower



Transfer pump may be removed as a unit for testing or to inspect lower pump housing. This unit contains relief valve.



Loosening two capscrews on each side of smoke stop permits sliding of stop. Move stop to rear for less fuel and smoke.



Governor spring and shim combinations for given engine applications are critical, changed only by authorized agency.

face of head. Tap cover in place and install "0" ring.

6. Replace head on pump.

Governor Adjustment:

No governor adjustments should ever be made except by or in the presence of a skilled operator.

Adjusting External Spring Governor:

Three adjustments are made on this type governor; the high and low idle speeds and smoke stop. These adjustments are made as follows:

1. Increasing external spring tension increases high idle speed. Maximum speed must not exceed that on nameplate.

2. Low-speed idle is regulated by a throttle lever stop screw.

3. Improper setting of full-load smoke stop may result in engine damage by overloading, and dilution of lube oil, or loss of power and torque characteristics. Where resetting is advisable use following method:

A. Remove cap from smoke stop on rear of pump housing.

B. Make a special screw driver to fit blade slots in the stop adjustment lock nut and loosen it.

C. With engine fully warmed up and operating under full load, turn smoke stop screw in or out until full-load smoke conditions are satisfactory.

D. Secure screw with lock nut and wire cap in place.

Adjusting Internal Spring Governor:

Since this type governor often has carefully selected spring and shims in combination, it should not be tampered with. When a change in engine application, operating conditions, or conversion of the driven equipment makes a governor characteristics change necessary, the spring and shims combination should be changed by an American Bosch Agency. Waukesha is also ready to help.

Within a reasonable range, the high and low idle speed may be regulated by adjustment of the throttle stop screws. The high idle speed is raised by backing off on high idle screw.

To adjust the smoke stop, loosen stop retaining screws and slide the stop forward or back until the desired smoke characteristics are obtained under full load condition.

Conclusion:

Adjustments of the precision made fuel pumps and governors on diesel engines should never be undertaken as a casual attempt to correct a supposed malfunction of some other part of the engine. In addition, even when adjustment or servicing is warranted on these precision parts it should be done by someone especially skilled at this type of work and who has had previous experience. Even then the manufacturer's specific instructions should be strictly followed. Naturally it will do no harm to learn how to make these adjustments and it may very well lead to a more responsible position and higher pay.

What Do You Know!

Here are some questions to test your general knowledge of the diesel field. Make your selections, then turn to Page 81 to check them.

1. Direct injection systems of diesel engines generally rely on two of the following conditions to get proper air-fuel mixture. Select the two.
   a. Size of the combustion chamber
   b. Atomization and distribution of fuel by the nozzle
   c. Motion of air in the combustion chamber
   d. Engine speed
   e. Compression ratio of the cylinder

2. It is possible to design a diesel engine combustion chamber which will burn fuels ranging from gasoline to diesel fuels without sacrificing engine performance.
   a. True b. False

3. Any time that fuel is injected so that it impinges on combustion chamber surfaces, incomplete combustion with resulting smoke, etc., will always occur.
   a. True b. False

4. It is possible to get the same or even greater power from a loop-scavenged engine of the same overall size as a uniflow-scavenged engine, because:
   a. Higher bmep can be obtained
   b. Fuel can be burned more completely
   c. Rotative speed can be higher
   d. Greater displacement in same size is possible.

5. Extending lube oil life arbitrarily to say 5000 or 6000 miles is advisable for economy sake.
   a. True b. False

6. The most accurate way of determining when a lube oil filter element should be changed in a truck diesel is by:
   a. The color of the oil
   b. The pressure drop across the filter
   c. The number of service hours.

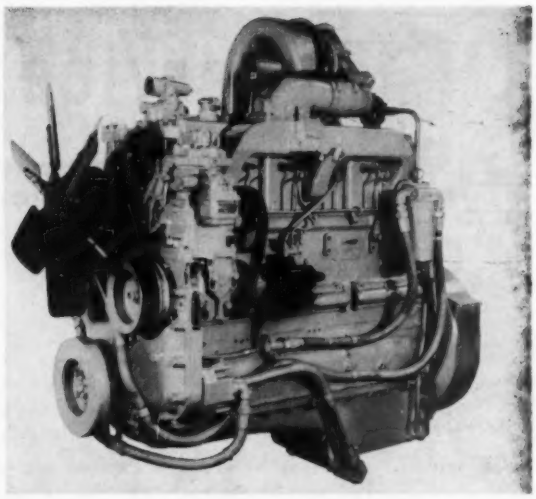
7. Two of the major factors influencing the degree of lube oil contamination are:
   a. Engine condition
   b. Miles of operation
   c. Fuel suitability
   d. Type of filters used

8. By changing the amount of fluid in working circuit of a fluid coupling you can:
   a. Vary torque transmission ratio
   b. Control output speed
   c. Vary the amount of slip.

9. When making smoke stop adjustment on a governor the engine should be warmed up and operating at:
   a. full-speed, no-load
   b. full-speed, full-load
   c. full-speed, overload

10. It is possible to cause bearing and even gear failures on an engine as a result of welding some external part of the engine, or tractor, or truck chassis in which it is mounted.
    a. True b. False

Cummins Turbocharges Two More Engines



MORE horsepower per pound and greater efficiency are the two uppermost improvements engine buyers are demanding these days. Cummins Engine Co., Inc., well-pleased with public acceptance of its recently introduced 175-hp JT-6 Turbodiesel for automotive and off-highway applications, has just announced production on two more turbocharged diesels. These will be available for industrial and marine as well as automotive and construction service.

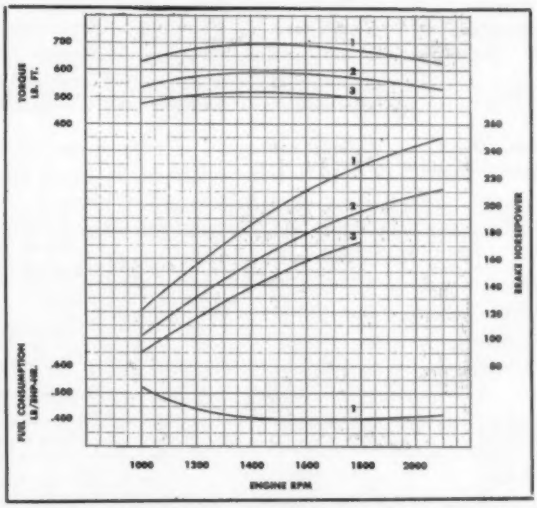
Called the NTO-6 and NT-6 Turbodiesels, they are rated 262 and 250 hp respectively, both turning at 2100 rpm. Essentially, they're of the same design as the 200-hp NH-600. They are 6-cyl, 4-cycle engines with bore and stroke of 5⅛ in by 6 in and a piston displacement of 743 cu in. Compression ratio is 15.5 to 1; weight is 2546 lb.

The extra horsepower gained by turbocharging is taken from exhaust heat-driven blowers and not absorbed from developed power as in the case of gear or belt-driven blowers, Cummins engineers emphasize. Therefore, they say, they have achieved what buyers are demanding—greater hp per lb weight of engine and greater efficiency.

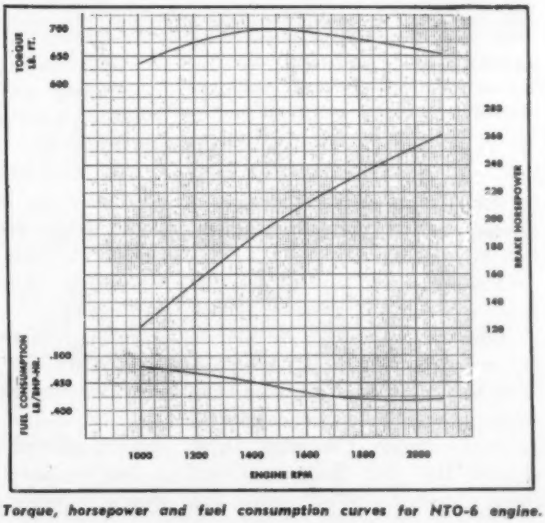
The turbochargers utilized by the engines are available mounted either on the side or top of the engine. This optional arrangement allows the power user to meet his various application requirements.

Both new models have a fully counterbalanced crankshaft, drop-forged from high-strength alloy steels. The bearing journals are induction-hardened and the crankshaft is protected from torsional vibrations by a viscous-type vibration damper mounted on the front end. Main bearings are steel-backed precision-type copper lead inserts with a total area of 192 sq in.

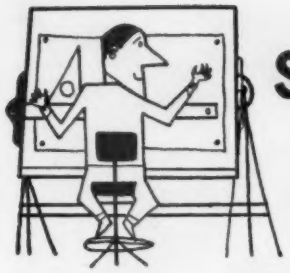
Cummins' PT fuel system is standard on the engines. Although No. 2 diesel or furnace oil is recommended for lowest operating costs, this system permits operation on all commercial diesel fuel weights. The water pump is of the circulating centrifugal-type, driven by two Vee-belts. Electrical equipment includes a 12/24-v system with a 24-v starting motor, a 50-amp generator, series parallel switch, voltage regulator, and pushbutton starting switch.



Maximum (1), intermittant (2) and continuous (3) torque and horsepower curves and fuel consumption curve for above Cummins NT-6.



Torque, horsepower and fuel consumption curves for NTO-6 engine.



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you

I-H—Fan Belt Tension Adjustment—UD-264, UD-350 and UD-14A Power Units; TD-6, TD-9 and TD-14A Crawler Tractors . . .

Fan belt life depends to a great extent on proper tension adjustments when it is first installed, and readjustments at proper intervals. Fan belt tension adjustment for the above models is as follows.

1. Before checking fan belt tension, rotate fan pulley toward side of belt to be checked, thereby removing slack from opposite side of belt.

2. Adjust fan belt tension to a point where belt can be depressed by thumb pressure (between the pulleys) approximately ½-in to ¾-in.

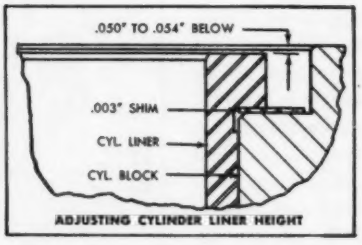
3. After each change in fan belt tension, rotate crankshaft pulley to reseat belt correctly in pulley groove before checking for ½-in to ¾-dimensions.

When fan belts are adjusted to these dimensions, the possibility of excessive slippage between the pulley and belt will be prevented.

GM—Usage of Cylinder Liner Shims—Series 110 Engines . . .

Whenever a mechanic is installing the cylinder liners into the cylinder block of a Series "110" engine, he should ascertain that the top of the liner flange is from 0.050-in to 0.054-in below the top surface of the cylinder block. Thus, the mechanic may find it necessary, on some occasions, to shift liners between cylinder bores to meet the required specification.

In some cases, the flange of the liners may brinnel into the counterbore of the cylinder block to the extent that liner flange to cylinder block



ADJUSTING CYLINDER LINER HEIGHT

height becomes affected. In these instances, Cylinder Liner Shim, Part No. 5192845, 0.003-in in thickness, may be employed as required to raise the liner in its bore until the top-of-liner-flange to top-surface-of-cylinder-block height specification is attained, as shown in the accompanying drawing.

Prior to installing the liner into the block bore, make sure that the counterbore in the cylinder block is perfectly clean and not damaged. The liner flange should be perfectly flat to ensure proper seating—the shim also should be perfectly flat and not distorted.

CATERPILLAR—Transmission Oil Recommendations—Tractors and Motorized Graders . . .

A new recommendation covering the use of transmission oils has been announced by Caterpillar Tractor Co., Peoria, Illinois.

Caterpillar now recommends that only an extreme pressure transmission oil conforming to the requirements of Mil-L-2105 specifications be used in the final drive compartments and transmissions of D8 Tractors Torque Converter Drive (Series D), D8 Tractors Direct Drive (Series E), D9 Tractors and No. 583 Pipelayers. The company is now filling transmissions and final drives of these units with Mil-L-2105 oil.

The Mil-L-2105 oils which are filterable may also be used in the transmissions and final drives of all other Caterpillar track-type Tractors, wheel-type Tractors and Motor Graders.

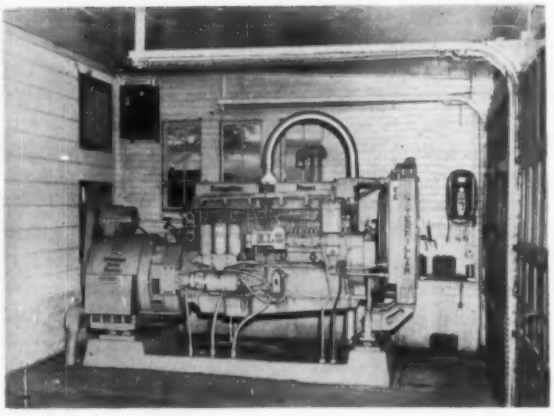
Formerly Caterpillar had recommended the use of straight mineral oils. However, experience has shown that Mil-L-2105 is superior to straight mineral oils.

The company stresses, however, that it is important to use the correct oil because some Mil-L-2105 transmission oils are not filterable. Additives in some of these oils may plug the transmission and final drive filters in a very short time. To determine which Mil-L-2105 lubricants are filterable, equipment owners should consult local oil distributors.

Viscosity or "grade" recommended by Caterpillar for various temperatures has not been changed. These are:

Below freezing	SAE No. 80
Above freezing	SAE No. 90
Continuous operation in extremely hot temperatures	SAE No. 140

news of our industry



Diesel Pays Off as Radio and TV Standby

Station KLZ, transmitting near Denver, Colo., is considered a pioneer in the use of diesel standby power to insure continuous and uninterrupted broadcasting service. August 25, 1947 is the date that an electric generating set was put on duty, and in this more than seven and one-half years it has accumulated over 500 hours of expensive air time operation.

The diesel unit has carried the station's entire transmission load for as long as 24 hours at one stretch while maintenance work was being done by the local power station. Mechanical difficulties are the major problem. Two principal outage causes are summer electric storms and the growing pains suffered by a power utility in a rapidly expanding suburban community.

The high altitude and climate in this area is conducive to electric storms. Once lightning struck the main line and caused a tremendous power surge that blew out 13 fuses at the station and ruptured an underground lead-covered feeder cable into the transmitter. Repairs to lines, meters, and transmitting equipment took their time and money toll; but the standby engine took over the load while they were being accomplished.

Now if even a dark cloud appears in the sky or flutters occur on the line, the transmitter engineer switches over to the standby as a precaution against outage or voltage dip.

The set in use is a Caterpillar 75-kw, D13000 which has a manually operated electric starting system. It can be started and carry a full load within five seconds. The engine's cooling water is kept continually warm to insure the quick starts. The transfer switch is within reach of the engineer seated at the control panel and is illuminated by a light connected to the engine's batteries so that it will not go out during a power outage.

Manual starting is preferred because if automatic start-stop were employed, the engine would be turned on with almost every voltage dip which occurs frequently at KLZ—sometimes as often as 10 times a day. A device has been worked out whereby power will only transfer from the standby to outside power, or vice versa, if there is adequate power available on the alternate source.

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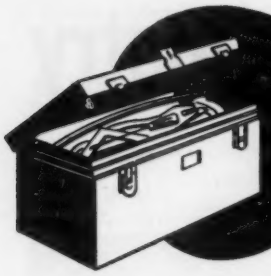


Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Changing Filter Elements

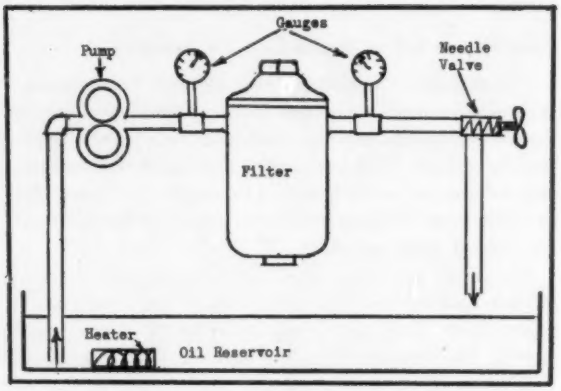
ANDY FILINGERI, Hoboken, N. J.—I've read your story on lube oil and filter changes in the Oct. issue of DIESEL POWER and I agree that a lot of us really don't know when to do either. Believe me, I have tried to find out. I've checked with other repair shops, oil company representatives, filter manufacturers and others. When refering to lube oil changes nobody seems to agree. As for filters, they all tell me the same thing. A good filter doesn't have to be changed until it's so loaded with dirt that the oil can't get through at reasonable pressures. But when I've asked them how you can tell when the element is full, that's when the trouble begins.

Nobody I've talked to seemed to know when the filter gets so dirty that all or most of the oil goes through the bypass valve or around the filter. So in trying to solve the problem, I've come up with a rig which tells me if the oil is getting through the filter. By use of a few parts put together as shown you can see the pressure on both sides of the filter.

Naturally, if the pressure on the outlet of the filter is much lower than on the inlet side the oil isn't getting through and the element must be stopped up. But even a new filter will have a pressure drop of about 5 lbs. Allowable pressure drop depends on manufacturer's rating, setting of filter bypass valve (if any) and may be limited by pump capacity. A safe limit should be picked, usually a little below the recommended maximum. Then the element should be checked from time to time and the number of miles of operation noted until the pressure drop becomes too high. I found this to be around 9000 miles. So, now I don't use the rig, I change all elements after about 8000 miles to be on the safe side. Of course this will vary under different conditions so you may come up with a different figure.

Now to make up this rig, a pump can be picked up around the shop and be hooked to a motor, also an old filter casing, piping, gauges and small tank or reservoir. To complete the rig all that's necessary is a cheap heater to keep the clean oil at engine operating temperature and a needle valve to get engine working pressure.

When oil temperature is up to normal, the pump is started and oil is pumped through the filter and back to reservoir. By controlling needle valve, oil pressure on the



gauge before the filter shows engine working pressure. Pressure difference between this gauge and the one after the filter is the pressure drop across filter.

Although it's not easy, filter pressure drop can be found on the engine by putting a gauge after the filter where the filter is arranged for full-flow or shunt cleaning. Bypass valves or the shunt line should be blocked. On bypass filters pressure drop can't be checked on the engine. Only gallery pressure is measured.

This rig only shows when an element must be replaced. Don't get the idea that it gives any indication of impurities such as water, fuel oil, etc., contaminating the oil.

We believe that the test setup made by Mr. Filingeri for determining pressure drop across a filter is practical, and a good approach to the problem. However it should be pointed out that sometimes filters become loaded with dirt almost overnight due to some conditions such as water leaks, excessive blowby resulting from broken or stuck rings, etc. This being the case, this test outfit is not foolproof. Prematurely loaded filters causing dirty oil to bypass around the element result in excessive engine wear. Since we're not aware of filter condition, lube oil testing is a good back up.

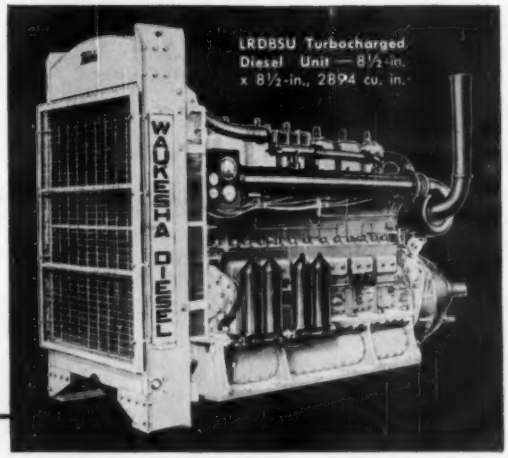
This re-emphasizes the point that the test setup will definitely not indicate oil condition. Although it gives an indication of length of filter life, it's important that oil be analyzed periodically.—Ed.

drilling with *NEW* EMSCO A-800 rig...

powered by three

WAUKESHA *Diesels*

At Pincher Creek, Alberta, Canada, Brinkerhoff Drilling Co. Ltd. are drilling with the new Emsco A-800, a medium-deep rig of "packaged portability" design. Its three Waukesha LRDBSU Turbocharged Diesel Units used here, add greater power at lowest fuel cost. ● Main drum has 6 forward, 2 reverse speeds; rotary has 3 forward, 1 reverse. No. 1 engine may be compounded with No. 2 engine and No. 3 engine. Pumps may be driven simultaneously at different speeds or any engine combination may drive either pump. Each LRDBSU Waukesha has 420 continuous duty hp at 1200 rpm. With its vibration-dampened counterbalanced crankshaft having seven 5½" main bearings, this big turbocharged Diesel has many outstanding characteristics including lively acceleration, clean burning, prompt starting, a tremendous reserve of power and great overall economy. Send for Bulletin 1606.



LRDBSU Turbocharged Diesel Unit — 8½-in. x 8½-in., 2894 cu. in.

291

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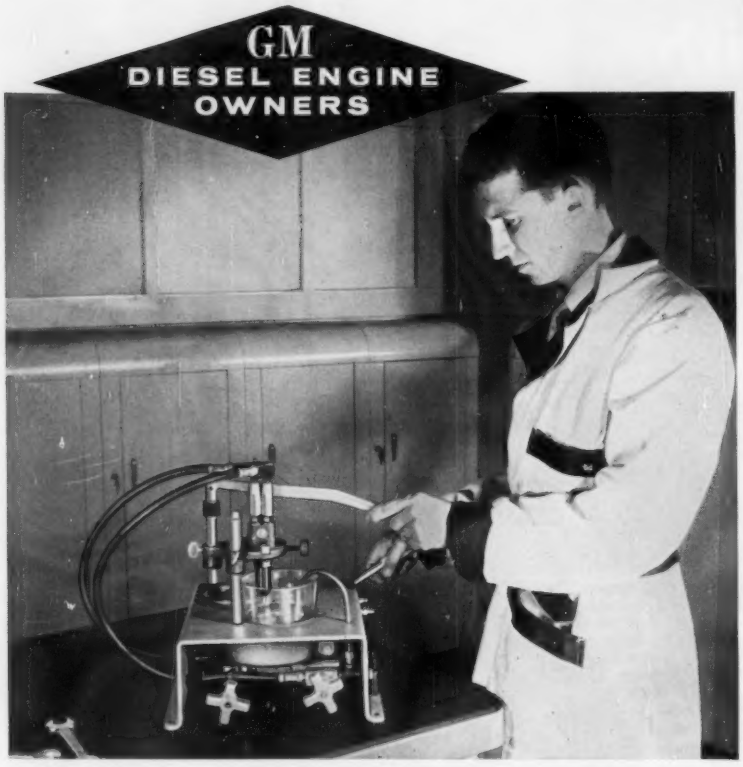
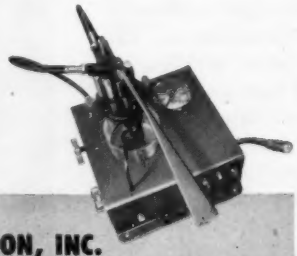


NOW! One Tester for ALL GM Diesel Injectors!

IT'S THE NEW KENT-MOORE *RATE-MAKER*® INJECTOR TESTER FIXTURE

Yes, now for the first time you can check *all* GM Diesel Injectors on *one* tester! That's right. The six tests specified for all Series 51, 71 and 110 engine injectors can be performed quickly and easily on the new Kent-Moore Injector Tester . . . and there are no special conversion units or individual holding fixtures to bother with either! Consider, too, some of the Tester's other outstanding features . . . a clear view plastic container that permits safe, unobstructed observation of the spray pattern . . . a positive lock, fine-adjustment popping handle for greater accuracy in checking leaks at pressures higher than the normal valve opening pressure of the injector . . . a fine mesh screen and ten-micron filter to guard against fuel system contamination . . . a sturdy 3,000 pound gauge with "lazy" hand for faster testing . . . oil resistant hoses and nylon-sealed connector fittings to insure long tool life. All these features, and many more, make it easy to see why the Kent-Moore Injector Tester is specified in your maintenance manuals. Order yours today!

The complete J 7000 Injector Tester, as illustrated at right, includes the basic testing instrument, J 5764, plus three adapter sets . . . J 7051-1, J 7071-1, J 7110-1 for testing Series 51, 71 and 110 injectors respectively. The adapters are offered separately for purchase in any combination desired. For complete information, write Kent-Moore direct today!



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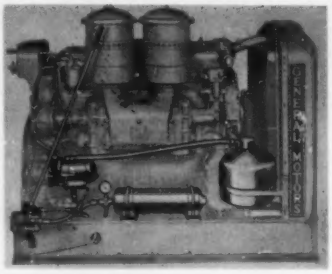
ENGINEERS AND MANUFACTURERS OF SPECIAL AUTOMOTIVE SERVICE TOOLS AND EQUIPMENT

news of our industry



GM's New Hydraulic Starter

Shown here superimposed on a Detroit Diesel engine is the first installation photograph of the new Allison hydraulic starting system—the Hydrostarter—which was described in October.

From left to right the parts are: manual pump, starter motor, pressure gauge, factory-sealed pressure accumulator, and oil reservoir. A small engine-driven pump, out of view, is installed at the rear of the engine.

Accumulator cylinder, hand pump, and oil reservoir can be positioned either on or off the engine to meet installation requirements.

Test Winterized Crane

Army engineers have announced successful preliminary field tests on a winterized 20-ton truck-mounted crane in northern Minnesota. It operated efficiently in sub-zero temperatures for 2 mo, equipped with special units developed by the Corps of Engineers.

The crane, designed to work in temperatures as low as -65°, uses special arctic lubricants to prevent freezing. Operator is protected by an enclosed cab. He is kept warm by the circulation of heated coolant from a gasoline burning heater or from the engine through a heat exchanger located in the cab. A modified engine enclosure prevents entry of windblown snow.

Exhaust gases from the heater provide heat for the battery and engine oil. Insulation reduces heat loss and noise level. After minor modifications, the crane was shipped to Alaska where more severe tests will be conducted this winter.

news of our industry

New British Diesel Locomotive

Napier & Sons, a subsidiary of the English Electric Co. has a new diesel-powered single-unit locomotive which is claimed to have the best power-weight ratio in the world. It is presently undergoing trial runs in northwest England.

Designed specifically for mainline passenger and freight duty where high speed and long haulage are required, the engine has been built for an in-service speed of 90 mph, although it can be geared to higher speeds. Known as the Deltic, the power unit uses light alloys and has been proved in marine service. As a locomotive engine, its chief feature is its ratio of 72 lb of locomotive weight for every hp. The single unit weighs 106 long tons and two of the engines together develop 3300 hp.

The Deltic is an opposed-piston 2-cycle which has a 2500-bhp power rating. It is constructed on a triangular cylinder arrangement resembling the Greek letter Delta. Each cylinder contains two pistons which work in pairs on three separate crankshafts. This permits 18 or 24 cylinders to operate in an engine space that would normally accommodate only three or four.

Army Engineers Needed

The Corps of Engineers' Research and Development Laboratories at Ft. Belvoir, Va. has issued an urgent call for electronics specialists to conduct basic and applied research on new devices for military use. Applicants must hold a degree in electrical engineering, physics, or mathematics, or have practical research experience in their fields. They'll have the opportunity of taking graduate courses at government expense. Mr. Walter H. Spinks, acting executive officer, is the contact.

CPR Orders More Budds

Five additional Budd rail diesel cars have been ordered by Canadian Pacific Railroad to bring the total number of these self-propelled units operated to 16.

handle ALL pulling jobs
swiftly . . . easily . . . with
Snap-on*
INTERCHANGEABLE
PULLER TOOLS

NO NEED to invest in an extensive, costly assortment of puller tools! Snap-on pullers and parts are *engineered* for maximum interchangeability. They handle the widest range of operations with greatest speed and safety with fewest units, lowest cost. The Industrial Puller Set illustrated, CG-608, will handle all puller operations encountered in most shops—size capacity up to 14" diameter with power up to 20 tons.

Write for Snap-on Industrial Catalog and General Catalog of 4000 hand and bench tools. A nearby Snap-on factory warehouse is ready to give you immediate service on all your tool requirements.

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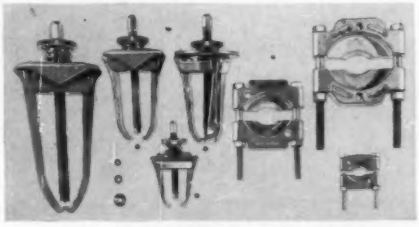

CG-608 Industrial Puller Set—Includes 4 screw-type pullers—small, medium (2-jaw and 3-jaw) and large. Size capacity up to 14", power to 20 tons. 3 Bearing Separators, up to 5¾" O.D. capacity, and Screw Point Protection Set.

CG-270H
8½" Jaw
Capacity
2-Jaw, Slide
Hammer Gear
Puller

Snap-on Tools
THE CHOICE OF BETTER MECHANICS

*Snap-on is the trademark of Snap-on Tools Corporation

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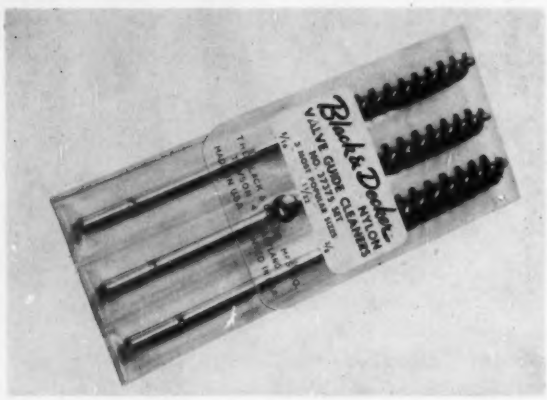


Valve Guide Cleaners

Ten different-sized cleaners, ranging from ¼ in up to 1 1/16 in, are the new line of nylon valve guide cleaners in production by Black & Decker Mfg. Co. They're designed to fit all engines in popular use. And for easy identification, the cleaner size is stamped on the shank.

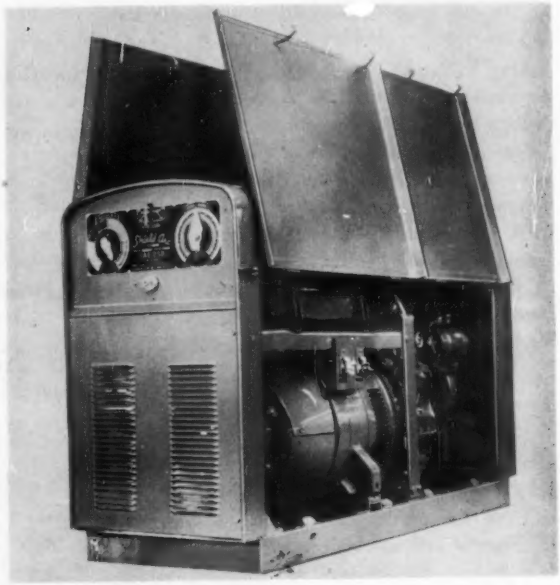
These wound-in-wire cleaners are said to be capable of removing all sludge and varnish, even from hard-to-reach oil grooves. Another claim is that they will thoroughly polish and burnish with no possible danger of scratching. Engineering tests, the company says, have shown little bristle wear after 50 continuous hours of operation, with no harmful effects imposed by gas and oil.

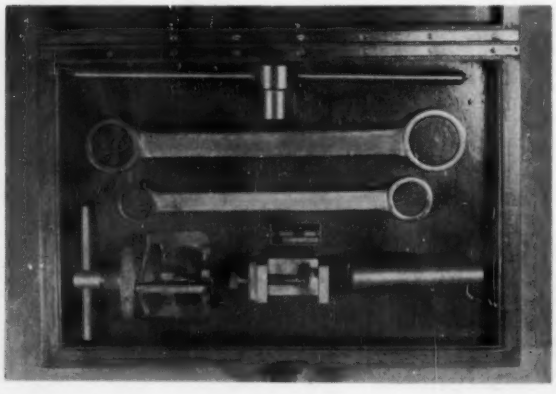
Diesel-Driven Welder

For construction, pipeline, and structural welding purposes, Lincoln Electric Co. has produced this "Shield-Arc SAE-250", rated 250 amp at 40 v, 60% continuous duty cycle. Featuring diesel-powered welding capacity in a compact design, it is said to weigh 25% less, be 1-ft shorter, and cost 25% less than a comparable 300-amp welder.

It is an addition to the company's line of dual continuous control welders which gives regulation of both voltage and amperage throughout the entire output range. Arc can be controlled as to type as well as intensity. It handles electrodes from 1/16- to ¼-in diam.

A Hercules DIX-4D, 4-cyl, 4-cycle diesel rated 39 hp at 1700 rpm supplies the power. It is equipped with a 12-v starting motor and ether injection system for cold weather starting. The generator has power outlets to provide 115-v, DC auxiliary power for operating tools and lights. Compared to a gasoline engine, claim is that only two-thirds as much fuel is required per hp hr.





Caterpillar Tool Set

Now being made available for immediate delivery from stocks in Boston is this service tool kit designed specifically for Caterpillar diesel engines. It is manufactured in Italy by the firm of Fera, and has been imported by G&K Diesel Service, exclusive United States distributors for the company.

In the words of the import agents, each set consists of "one fixture for injector lift, one service group pliers, one puller for pumping unit lock rings, one box wrench for pumping unit delivery valve holders, two box wrenches for all injectors and pumps, and the tool box." None of the tools, the company adds, will be sold individually.

THE BEST KNOWN GUIDE TO

Diesel Design . . .
Maintenance . . .
Operating Data

THE DIESEL ENGINEERING HANDBOOK

Now in its brand *new*, 835 page, 9th Edition, the DIESEL ENGINEERING HANDBOOK is read by 55,000 top men in all industries building, servicing, or operating Diesels—Construction . . . Trucking . . . Stationary Installations . . . Marine Use . . . Railroading.

More than 900 separate Diesel topics are reviewed. Its 30 chapters analyze such vital Diesel subjects as:

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- *Cooling Systems*
- *Fuel Oil*
- *Diesel Lubrication*
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- *Supercharging*
- *Starting Systems*
- *Engine Air Systems*
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Here's what the Automotive Engine Rebuilders Association Bulletin has to say of the DIESEL ENGINEERING HANDBOOK:

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Order *now*, and put it to work for YOU. You'll want to consult it every day—to keep abreast of the most efficient maintenance procedures . . . to know the construction details of every Diesel . . . to insure reduced equipment "down-time".

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HB 11/5

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Get maximum efficiency
longer engine life

for BUSES • TRACTORS
TRUCKS • BOATS

EASY TO INSTALL
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ILLUMINATION

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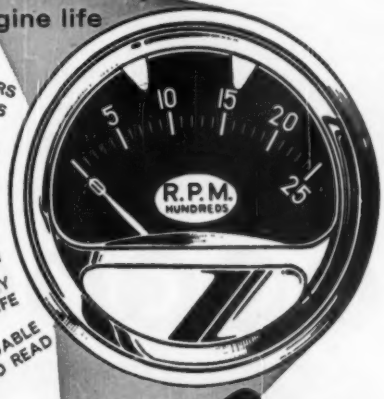
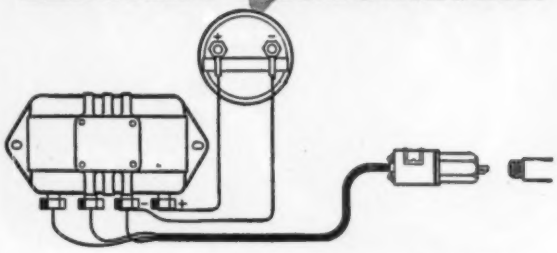
NO BATTERY DRAIN

HIGHEST ACCURACY
LONGEST SERVICE LIFE

RUGGED, DEPENDABLE
EASY TO READ



with new **Sun**
MECHANICAL DRIVE
ELECTRIC TACHOMETER!



Now, New Sun Mechanical Drive Electric Tachometer for diesel engines gives consistent, more accurate RPM readings for greater diesel efficiency and economy!

Operation is simple and foolproof. The new Sun Power Units are available for standard S.A.E. drive ratios—and S.A.E. mechanical drive outlets. Troublesome, long drive shafts are eliminated. The Sun Transmitter Unit attaches to any S.A.E. mechanical drive outlet where electrical impulses are picked up and transmitted to the Power Unit and then relayed to the "Tach" head in terms of RPM.

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CLIP THE COUPON—MAIL TODAY! Complete information will be sent immediately.

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for greater GASOLINE ENGINE economy . . .

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(GASOLINE ENGINE)
☐ SUN ELECTRIC TACHOMETER
☐ SUN DRIVING GAGE

NAME_____

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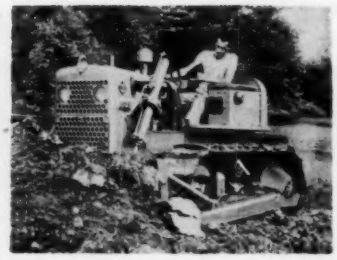
CITY_____ STATE_____

new products

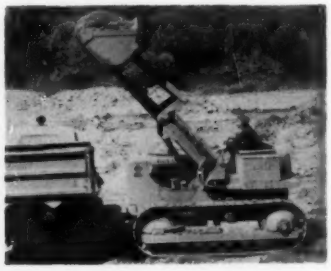
Two New Diesel-Powered Movers

The HD-6 crawler, weighing 12,400 lb, and the HD-6G tractor shovel, weighing 19,600 lb, are the latest developments at Allis-Chalmers. Both include the company's HD-344 engine, a 4-cyl, 4-cycle unit that develops 57 net flywheel hp—45 hp at drawbar and 55 hp at the belt.



The HD-6 has a maximum drawbar pull of 12,650 lb and has five forward speeds and 1 reverse. It offers heat-treated track shoes; positive-seal roller-bearing truck wheels; idlers and support rollers which require lubrication only once each 1000 hr of operation; full width crankcase guard; muffler; 24-v electric starting and lighting equipment; and front bumper.

The HD-6G has four forward speeds and two reverse. Its standard equipment includes six truck wheels per side with 83 3/16 in of track on the ground for maximum stability without use of counterweights; 1 1/3-cu yd, 2-position bucket; shovel hydraulic system with triple filter protection; semi-grouse track shoes; full truck frame guard equipment; heavy-duty front idlers; push fan; and "Wrap-around" radiator guard.



Aluminum Protective Coating

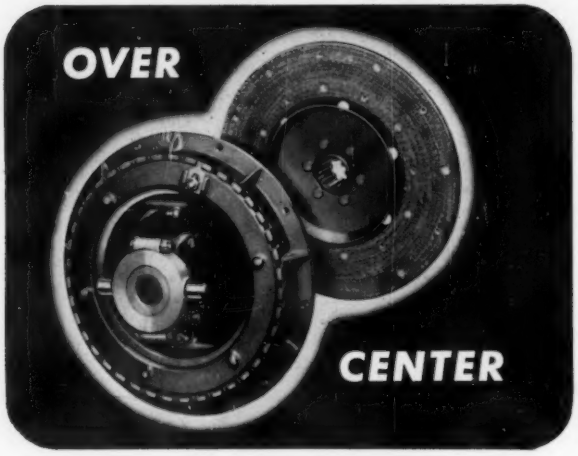
To protect aluminum truck trailers from the inroads of grit, road salts, and weather, Eastman Chemical Products, Inc. and The Egyptian Lacquer Mfg. Co. have jointly developed a butyrate lacquer coating called Clear Coating-CH64. Standard paint spray equipment is the application agent, the coating drying in 15 min at room temperature.

No priming coat is required on new aluminum, a solvent wash being the only preparatory step. On weathered aluminum, a standard phosphoric acid pre-wash is recommended.

Masonry Drive Rivet

South Chester Corp. announces a low-cost method for attaching metal to masonry. It is a 1-piece rivet which requires no special tools. Hole is drilled in brick, cinder block, concrete, or similar materials, the rivet inserted, and then driven with a hammer. Made in ¼-in diam, the rivets come in six lengths from 1⅛ to 1¾ in, by ⅛-in increments.

ROCKFORD



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POSITIVE ENGAGEMENT
LARGE DRIVING AREA
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INFREQUENT ADJUSTMENT
MINIMUM INERTIA

* ROCKFORD Over-Center CLUTCHES remain in or out of engagement until changed by the operator. The smooth, easy, anti-friction engagement—obtained by roller cams pressing against the pressure plate face—progresses from "release" to "on center" to slightly "over center" where the clutch locks in engaged or running position.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 1301 18th. Avenue, Rockford, Illinois, U.S.A. ▲

CLUTCHES

new products

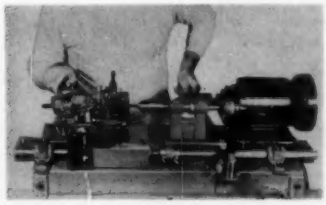
Piston and Valve Cleaners

Two shop machines which are claimed to reduce cleaning of valves and pistons to a matter of seconds have been developed by Practical Mfg. Co.

The piston cleaner, called Kleer-Flo Pistonmaster, is semi-automatic requiring no skilled operation. After being placed in the machine, the piston has its skirt, head and ring grooves cleaned in 15 sec. Flat or dome heads can be accommodated. Cleaning agent is a non-abrasive liquid solvent. The machine is mounted on casters.

Called KleerFlo Handi-Master, the valve cleaner is a portable machine which handles up to ½-in stem valves. A series of metal spring-mounted cutters and scrapers do the cleaning job after the valve is locked in place in the chuck, a 1/3-hp motor providing rotating force. Even valves with depressed crowns can be handled, it is stated, the whole operation taking 10 sec.

The machine is also a multi-purpose cleaner that can be converted to a horizontal drill press, buffer, or grinder.



Chemical Wire Stripper

For consumers of insulated wire, Chemclean Products Corp. has developed Chemclean No. 493, which removes Formvar, Formex, Isonel, and baked enamel coating from wire. The material is so formulated, it is claimed, that wire dipped into it is uniformly coated with the stripper. The wire is then ready for soldering or other processing. The chemical may also be used on vertical and overhead surfaces.

Spot Fire Control

Small fires fed by flammable liquids or gas, or caused by electrical shorts, may now be controlled by a push-button aerosol package that uses a dry powder as the fire-killing agent. Safe Inc., the manufacturer, claims it is up to five times as effective as carbon dioxide or foam, and eliminates the toxicity associated with carbon tetrachloride which is used in many aerosol extinguishers.

Packed in a non-reusable 12-oz container, the product uses a specially treated bicarbonate of soda and is said to be capable of putting out a 3-sq ft gasoline pan fire, 6- to 10-ft gasoline spill fire, or a 5-sq ft pan fire of kerosene or fuel oil. It is also said to provide a quick knockdown on Class A fires, reducing the blaze to embers which can be killed with a minimum of water. DuPont's freon provides the dispensing pressure in the package.

The World's Leading Manufacturers of FUEL INJECTION EQUIPMENT for Diesel Engines

C.A.V.

Depots and Service Agents in over 100 Countries

C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., 653, TENTH AVENUE, NEW YORK, 36, N.Y.
Sales Office: 14820 DETROIT AVENUE, CLEVELAND, 7, OHIO.

AP174-754

new literature

As a Service to Truckers
White Motor Co. has published a revise of its popular "Driver Selection and Training". Purpose is to assist development of driver programs tailored to individual operations. Typical forms and tests for most practical driver programs are included.

Railroad Cleaning Procedures
are detailed in a 50-page release from Wyandotte Chemicals Corp. Every type of cleaning job, from the diesel locomotive and its parts to dirty floors, is given full coverage.

Turbochargers for Diesels
in every field of application are covered by the AiResearch Industrial Div. of Garrett Corp, in a new catalog. Models for various density ratios are detailed along with typical performance characteristics.

Torque-Type Locknut
specifications, the first to be published, are a special feature of the latest edition of "Fasteners", available from the Industrial Fasteners Institute. Articles of interest include heating and driving practice in riveting, and different applications for all-nylon fasteners.

Alternator Systems
designed for truck fleets are described in a 4-page brochure by Leece-Neville Co. Operation and installation information, plus detailed specifications, are included.

Screw Machine Products Buyers
will be interested in the latest 74-page free directory of the National Screw Machine Products Assn., listing location and facilities of all its members.

Stainless Steel Fastenings
available from stock are featured in a new catalog from Star Stainless Screw Co. The line ranges from cap screws to pipe fittings and all are shown with diagrams and charts of sizes to facilitate ordering to specific need. Also included are corrosion resistance tables and standard stainless steel specifications.

Air Compressors
ranging from 1/3 to 20 hp are described in a brochure just received from American Brake Shoe Co. It covers pumps and tank-mounted systems, and single and 2-stage gasoline and electric motor-driven units. A compressor selector chart is included.

Plant Automation
that can be obtained through use of relatively inexpensive off-the-shelf equipment is described in the current issue of "Instrumentation", publication of Minneapolis-Honeywell Regulator Co. A series of case histories supplies the practical examples.

STOP THAT NOISE!

and for intake and exhaust noises use BURGESS-MANNING SNUBBERS

They are the surest way to eliminate nerve-racking intake and exhaust noises from engines, compressors, blowers, vacuum pumps, steam or gas turbines, etc. They promote better neighbor and employee relations — eliminate needless strain, fatigue and costly errors in oral communication and improve equipment efficiency. "PLUS" functions of spark arresting, heat recovery, water separating, air cleaning, and surge control can be integrally included.

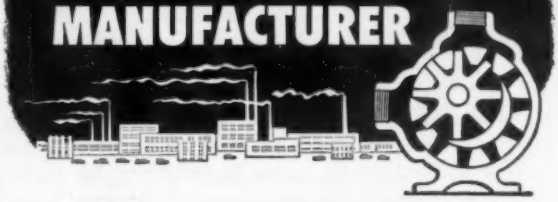
Send us a description of your problem!

BURGESS-MANNING COMPANY

Sound Engineering 751 East Park Avenue, Libertyville, Illinois
Dallas, Texas

Why Viking Pump is the

MANUFACTURERS' MANUFACTURER



Many original equipment manufacturers include Viking Pumps as components of their products. Vikings make possible custom-engineered pumps that serve their needs better, and at mass production prices. They benefit from more than forty-four years' experience, engineering skill and research on Viking Pumps. In many ways, Viking facilities serve to better advantage than a branch factory or special pump department.

If you have a product with a pumping problem, call on Viking engineers. With more than 750 cataloged models and thousands of specially applied pumps, Vikings may solve your problem at a big saving. For information, write for Bulletin Series 55Sd.

VIKING PUMP COMPANY Cedar Falls, Iowa, U.S.A.
In Canada, it's "ROTO-KING" pumps
THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP

new literature

Vibration Control Requisites

from delicate instruments to heaviest impact machinery are treated in a catalog from Vibration Mountings, Inc. Typical installations as well as specialized problems are illustrated. Diagrams and charts give easy selection of type and size of mountings available.

How to Select Grinding Wheels

for precision grinding of tool and construction steels is the subject of a booklet offered by Norton Co. It is fully illustrated and includes charts of grindability values and tables of recommendations.

Dry-Type Fluid Coolers

developed for liquid or gas cooling applications are given complete construction, performance, and maintenance treatment in an 8-pager from Trane Co. The coolers use air as a cooling medium and applications shown include gas compressor intercooling, and jacket water and lube oil cooling.

The Last Mile

for this car occurred on a poorly maintained road which was being reconstructed. It's also the title of Caterpillar's latest contribution to safety education, a 20-min film pointing out the dangers involved when construction crews begin the job of making an old overcrowded road into a safe modern highway. A message for both the motorist and the construction worker is contained.

What is a Turbodiesel?

What are the advantages of turbocharging? How does a turbocharger work? These questions are answered in the latest release by Cummins Engine Co., Inc., which is currently producing five turbocharged diesels available for automotive, marine, and industrial applications.

Lube and Fuel Oil Maintenance

for both diesel and gas engines is detailed in the latest release of The Hilliard Corp. The analysis divides oil contaminants into two groups with recommendations for filters. A tabulated chart based on engine hp gives the proper type and size of equipment needed.

The Story of Inner-Fin

Bush Mfg. Co.'s patented heat transfer surface, is contained in an engineering brochure recently released. General application information is also given.

Fork Lift Fact Folders

designed to help in selection of the right materials handling equipment for specific operations are being published by Towmotor Corp. First of the series is a 4-pager on the company's new Model 500.

Grinding and Lapping Machines

for every major precision application are fully detailed with photos and specifications in a 32-page general catalog published by Norton Co.

organizational news

Heading the Eastern Region
at Penn Controls, Inc. is A. W. Barr recently upped from his former post as Boston district manager. James Garrett takes over in Boston.

Named a Board Member
at Viking Instruments, Inc., John F. Glump, former sales manager of its Econo Div., has also been promoted to vice president in charge of sales and advertising.

John F. Glump

Service Office Changes
at White Motor Co.'s Diesel Engine Div. involve a new location for the Houston branch which is now at 5707 Navigation Blvd. and a change in address for the Fort Worth branch, now at 6100 Camp Bowie Blvd.

Newest Staff Member
at Chromium Corp. of America is Fay Thomas, former general superintendent for the New York Central Railroad. He'll concentrate on development and expansion of activities in the railroad industry which makes extensive use of chromium plating in reclamation of diesel engine cylinder liners and other assemblies exposed to wear.

Parts Sales Managership
for the tractor group at Allis-Chalmers Mfg. Co. has been assigned to J. D. Harmison. He has been with the company since 1939.

Assigned to Washington
by Cooper-Bessemer Corp., Frank W. Quiggin will be responsible for engineering and sales of compressors and engines to federal agencies as well as for general industrial use.

Frank W. Quiggin

Here's Why

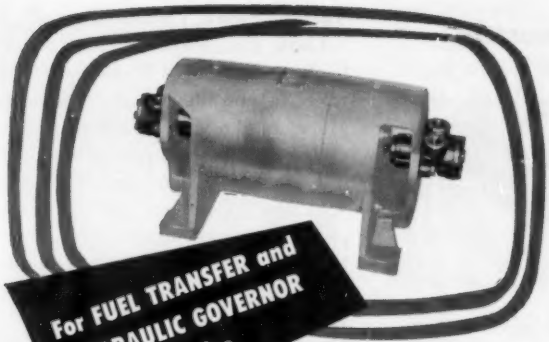
PERFORMANCE IS BETTER WITH Bendix STARTER DRIVES

CHECK and COMPARE THESE FEATURES

- Starting motor can be mounted more easily and in more positions.
- Requires no actuating linkage—solenoid can be placed in any convenient position.
- Simple in design—has fewer parts—needs fewer adjustments.

It takes a truly outstanding product to receive over 100,000,000 endorsements. Yet, that's the number of Bendix Drives that have been installed. No other starter drive approaches this record of outstanding performance. That is why, whatever your type of diesel or whatever its purpose, it will pay you to specify Bendix* Starter Drive for the most economical installation and dependable performance. *REG. U.S. PAT. OFF.

ECLIPSE MACHINE DIVISION of Bendix AVIATION CORPORATION
ELMIRA, NEW YORK
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N.Y.



For FUEL TRANSFER and HYDRAULIC GOVERNOR Service

TUTHILL

MODEL L PUMPS ARE PERFORMANCE-PROVED

Throughout the diesel industry, Tuthill Model L pumps are recognized for their dependability in fuel transfer and hydraulic governor service. Model L is a mechanically-sealed, positive displacement internal-gear rotary pump, assuring quiet, leak-free operation with low power consumption. Capacities from .33 to 6 g.p.m. in wide pressure ranges. Available as single or double-pump units. Write for Catalog No. 101 including Pump Guide for diesel applications.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Ill.

Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

KIENE®

DIESEL

indicator valves

OPERATES AT PRESSURES UP TO 10,000 PSI

Kiene valves have effective gas seal both open and closed without packing or glands. Operate against pressure — will never blow open. Small and rugged — 4¼" in length with only 3¼" circle of space for attachment. Kiene valves give better service under the most severe conditions. Standard indicator plug and wing nut connection.

Furnished with male ½" NPT engine connection. Other threads on order. Adaptations for most diesel locomotive engines.

SEND FOR BULLETIN V-10

KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

Moving Up as Vice President
in charge of research and engineering at Ethyl Corp., is Dr. George F. Kirby. He succeeds B. Bynum Turner, who has stepped into the post of executive vice president.

Advanced to President
of Warner Lewis Co. upon the resignation of Mr. Lewis is J. N. Fitzgerald. With the company since 1948 as vice president until it was acquired as a wholly owned subsidiary by Fram Corp., Mr. Fitzgerald was most recently vice president of sales in the Washington, D. C. office of Fram.

J. N. Fitzgerald

Head Industrial Designer
for Joy Mfg. Co. is now Robert M. Van Tassel. He's been with the company for seven years.

A. F. Stevens

J. E. Mott

New Unification Setup
at Van Norman Co. has resulted in the promotion of Abbott F. Stevens as advertising manager for both the automotive and machine tool divisions of the company, and John E. Mott as general service manager for both divisions.

New York Air Brake Promotion
in the capacity of chief plant and equipment engineer has been won by Frederick L. Guyette. He's been with the company for 25 years.

Raised to Executive Engineer
at the Electro-Motive Div. of General Motors is the former locomotive section engineer, T. B. Dilworth. His new capacity brings the responsibility of design and development of products.

Heat Transfer Design
is the specialty of Frank L. Rubin, newest member of the sales engineering staff of Downingtown Iron Works, Inc.

Dealer and Distributor Sales
for Clark Equipment Co.'s Transmisson Div. are now under the management of Donald E. Stoops. He was lastly advertising and merchandizing manager for the same division.

D. E. Stoops

How much **of your engine maintenance bill is due to repair of breakdowns that could have been avoided—*if you'd had advance warning?***

At a fraction of that cost, Alnor Exhaust Pyrometers offer you a constant check of engine performance—advance warning of

Cylinder Overload	**Preignition**
Scaled Jackets	**Clogged Ports**
Detonation	**Faulty Injection**

Get the best from your diesel—minimum fuel consumption per horsepower and long service uninterrupted by foreseeable breakdowns. Get constant protection of your engine, cylinder by cylinder, with an Alnor engineered Exhaust Pyrometer System.

Get Full information—Quickly! **Your nearby Alnor Diesel specialist is conveniently listed in the classified directory. Ask him to help you select the Pyrometer and thermocouple assembly designed for your engine. Or send for Bulletin 4361 with complete details of the full Alnor line of Pyrometers.**

ILLINOIS TESTING LABORATORIES, INC.
Room 507, 420 N. La Salle St., Chicago 10, Illinois

new products

Self-Sealing Fasteners

Reusable fasteners, whose heads seal to the mating surface, are being produced by Aero Bolt & Screw Co., Inc. Sealing is accomplished by use of a standard AN or MS O-ring fitted into a groove cold-headed into the fasteners. A thin teflon washer is placed between the O-ring and the head to eliminate friction and allow the rubber to flow evenly in all directions.

The bolts incorporate the lengths and grips found in AN and NAS standards, with slightly oversize heads. This is said to provide a greater sealing capacity needed under shear action and a greater sealing area required for oversize holes. Head styles include the 100-deg countersunk type.

Vibration Hangars

Designed to prevent transmission of noise and vibration from suspended equipment and to flexibly support piping systems, Finnflex Types S and SC spring vibration mountings are the newest products of T. R. Finn & Co., Inc.

They are intended for use where large deflections are required due to thermal expansion of pipe lines, where high and low temperatures are involved, and where very low disturbing frequencies are encountered.

Each unit consists of a helical steel spring enclosed in a steel housing. Suspended load is transferred to the spring by means of rods or bolts with washers that rest on bearing plates enclosing the isolating medium. The top bearing plate is capped with a rubber washer and the bottom of the housing has a rubber damper. Rated load capacities range from 50 to 1000 lb.

Turbocharged Tractor Shovel

Clark Equipment Co. has assembled a turbocharged Waukesha diesel rated 165 hp into its new Michigan Model 175A. This makes it the world's most powerful rubber-tired tractor shovel, they say. With the Schwitzer - Cummins turbocharger packing air into the cylinders, combustion is improved, power is boosted, and ample power is provided for operation at high altitudes.

Weight of the unit is 24,100 lb; bucket capacity, 2¼ cu yd. It has 4-wheel drive and rear-wheel steering. Other features include a torque converter, power shift transmission, and planetary-wheel drive axles. Four forward and reverse speeds are provided; speed is 27-mph maximum.

All-Around Utility Grinder

Engelberg Huller Co., Inc., has added Model 648 to its line of abrasive belt grinders to meet the need of shops for an all-purpose grinder.

Principal applications of the grinder include free-hand work such as flat surfacing, squaring, rounding, deburring, chamfering, and polishing. Adjustable to any angle up to 90 deg in 5 sec, it is said to be capable of handling fairly large as well as small pieces. It has a 6-in belt backed by a 6⅜-in by 14⅛-in platen. A large knob on the side of the machine regulates tracking.

Truck Leveling Device

To facilitate efficient handling to and from highway trucks without need for conventional ramps or dockboards, Rowe Methods, Inc. has designed the Adjust-A-Truck. It is built into the pavement in front of a loading dock and by means of a heavy-duty hydraulic system, raises or lowers a truck or trailer until the bed of the vehicle is even with the dock.

new products

"World's Largest Towing Winch"

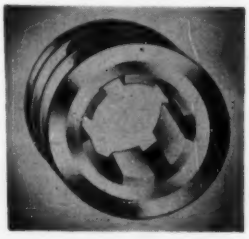
A line pull of 76,000 lb is developed by the new Model D9A, just produced by Hyster Co. for the huge Caterpillar D9 tractor. It is claimed to be the largest winch in the world, and is available in two versions: one for the direct drive tractor, and the other with alternative intermediate gear train for the torque converter model.

The unit features a constant mesh transmission, flexible cable controls, built-in drawbar, cast alloy-steel drum, 15-in brake, hardened gears, and brake compartment sump. An automatic brake is optional. Net weight is about 3250 lb. Barrel diam of the drum is 16 in, flange diam is 27 in, and barrel length 11 in. Cable capacity is 269 ft of 1⅛-in line or 217 ft of 1¼-in line.

Through-Broached Socket Screw

The socket extends the full length of the screw in this new version of the socket set screw, available from The Bristol Co. It comes in a range of sizes starting with No. 4 wire in either the hex or multiple spline socket, and is symmetrical so that it can be wrenched from either end.

No grinding or modifications are said to be necessary for its use with power screw drivers. Its holding power equals conventional socket set screws and it is claimed usable both as a set screw or locking ring.

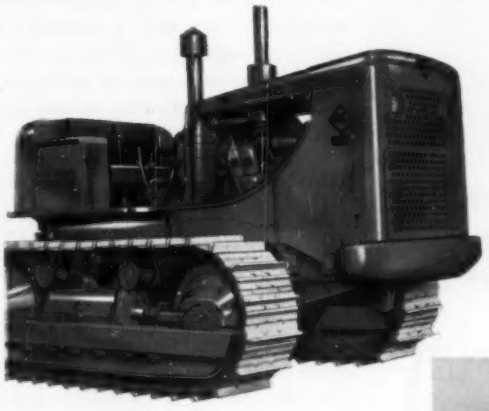


Oil Disc Filter

Replacement of discs is claimed easier with a newly designed bolted-head Model I 6-15 D disc filter, manufactured by U. S. Hoffman Machinery Corp. For industrial oil filtration, the filter is designed to provide 5 to 50 gpm at operating pressures up to 50 lb.

Head and body of filter are attached by eight nuts and bolts. The filter consists of a cast aluminum body attached to a cast aluminum head. Two bored holes in the head are threaded to receive pipe for clean and dirty coolant lines.

Filtration is accomplished by a series of metal screen discs covered by cloth. A spring-held perforated metal tube extends from the bottom of the filter to the clean coolant outlet to support the filter discs and act as a manifold. A relief valve may be installed in conjunction with the external piping if required. Flow rates depend on dirt content and viscosity of liquid. The filter removes dirt particles from 3 to 5 micro inches.



DIRT STOPPERS FOR DIRT MOVERS

United Air Cleaner Protects New Allis-Chalmers Tractors

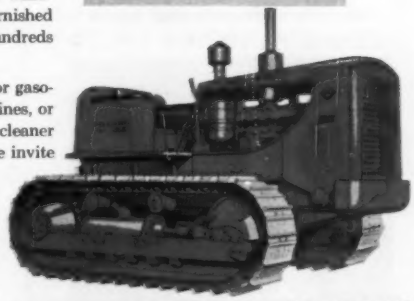
These two new Allis-Chalmers tractors can move dirt more effectively because both are safeguarded against engine-damaging dust and dirt — they are protected by United Oil Bath Air Cleaners.

Even under the dustiest earth-moving work conditions, only clean, abrasive-free air enters the combustion chambers of the powerful new Allis-Chalmers diesel engines. The protection furnished by the United Oil Bath Air Cleaner adds hundreds of hours to the life of engine parts.

Whatever the engine—heavy-duty diesel or gasoline for tractors or trucks, passenger car engines, or small portable power units, United has an air cleaner —or can build one—to meet your needs. We invite your inquiry.

Allis-Chalmers new diesel crawler tractors

(Above) 31,500 lb Model HD-16
(At Right) 20,500 lb Model HD-11



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new products

Safety Solvent Cleaner

Boost is the tradename of a new volatile solvent concentrate which does not burn and is claimed to impart fire extinguishing qualities to lower-cost solvents. It is said to boost the dissolving power and drying performance of these solvents so that they act much faster than carbon tetrachloride.

Curran Ordnance Chemical Laboratory, its developer, has packaged the compound in a hermetically sealed 1-lb tin and is selling it through distributors. Claim is that each 1-lb tin will make a gallon or more of highly effective safety solvent.

Vibration Control

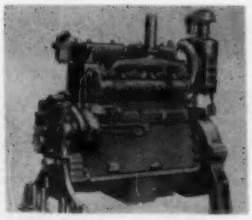
Users of machinery with rotating parts will be interested in a double-functioning level mount which permits quick and easy leveling without lagging to the floor and also acts as a vibration absorber. It consists of a metal plate with an Isomode pad cemented to it, a threaded bolt, flanged leveling nut, and locknut.

To install on machinery already in place, the footings are raised to permit the mount to be slid in, the bolt is inserted through foot, and flanged nut threaded on. When the machine is level, the locknut is tightened. MB Mfg. Co. is making the unit available in six models. Permissible load ranges extend from 100 to 12,000 lb per mount.

Sight-Flow Indicators

For viewing liquid flow in pipe ½- to 2-in NPT, Jerguson Gage & Valve Co., 80 Fellsway, Somerville, Mass., announces a complete line of sight flow indicators. Visibility of liquid flow is added to by obtaining turbulence through the interrupted bore of the fitting.

Several types of indicating vanes are available for variable conditions of flow rates and viscosities. The indicators are of transparent 1- and 2-window types, with a Reflex-type which only shows that liquid is in the line. All indicators come in a variety of metals and linings.



Two Basic Engine Models

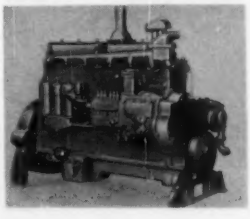
Caterpillar Tractor Co. has announced two replacements in its line of industrial diesels: the D339 in place of the discontinued D8800 and the D342 to replace the D13000.

The D339, the same engine that powers the D7 tractor, is a 125-hp, 1200-rpm, 4-cycle, 4-cyl, valve-in-head diesel with a 5¾-in bore and 8-in stroke. It gives 25% more hp and operates at 200 more rpm than its predecessor.

One of the new features is an engine balancer, permitting its four cylinders to operate as smoothly as a 6-cyl design. Two off-set weights rotate at twice engine speed and are timed, it is claimed, to eliminate the unbalanced forces said to be inherent in 4-cyl engines.

Most of the oil lines have been placed inside the block and a new design oil pump, of the pressure by-pass type, driven from the balancer drive, has been introduced. Impregnated paper filter elements replace the smaller cotton-wound elements.

The D342, which powers the D8 tractors and No. 583 pipelayers, is a 5¾-in bore by 8-in stroke, 6-cyl diesel, giving 190 hp at 1200 rpm. It has a new and larger capacity water pump; its lines and tubes have been placed inside the block; and it has capsule-type fuel injection valves. As with the D339, the governor has a 10% speed regulation between no load and full load throughout the entire speed range. A choice of three starting systems is available: air, direct electric, and gasoline.



news of our industry

Fastener Ductility Important

Continuing its information service to the trade, Russell, Burdsall & Ward, fastener experts, advise that it is not enough that a fastener have high tensile strength. It must also have suitable ductility or toughness. Ductility is an ability to be deformed without breaking.

As a general rule, they state, the greater the tensile strength, the less the ductility. Therefore the correct proportion of tensile strength and ductility must be obtained for each specified set of conditions. Heat treatment is said to be the only means of providing the proper balance between tensile strength and ductility. Cold-working increases tensile strength at the expense of ductility. Also, it is more difficult to control the amount of tensile strength.

When toughness is required to withstand heavy load conditions, it is necessary to select the suitable steel and heat treatment to obtain the optimum combination of tensile strength and ductility. High-carbon cap screws, identified by black finish and three radial lines on the head, are designed for heavy load conditions and are quenched and tempered to get the best combination of physical properties. Cold-headed machine bolts are stress-relief annealed after cold-working to increase ductility. Low-carbon cap screws, which have a bright finish for appearance, are not heat-treated after cold-working.

Santa Fe to Add 69 Diesels

The fleet of Santa Fe Railway will be increased by 69 diesel locomotives begininng late this year. New equipment will include nine 7000-hp freight diesels, each locomotive consisting of four units of 1750-hp each, and 32 1750-hp road switchers. These will be built by the Electro-Motive Div. of General Motors Corp.

Ten 2250-hp road switchers will be delivered by Alco Products, Inc. And Fairbanks, Morse & Co. will complete the total with 18 1200-hp yard diesels. The entire order is expected to be in full service by August 1956.

What Do You Know!

(*Answers to Questions on Page* 62)

1. Correct answers are "b" and "c". Number and size of fuel particles, penetration into the combustion chamber and air motion to envelop particles with air creates a good mixture. See article on Page 38.

2. Correct answer is "a". MAN "Whisper Engine" is one such engine. See article mentioned above.

3. Correct answer is "b". MAN M-combustion chamber is designed for continuous operation with fuel impingment. See article mentioned above.

4. Correct answers are "c" and "d". Elimination of valve gear permits higher rpm. Space and weight saved are used for added displacement. See article on Page 52.

5. Correct answer is "b". Wear and deposits resulting from impurities may not be noticeable for months. Don't extend life unless oil is proven good by analysis. See article on Page 46.

6. Correct answer is "b". Excessive pressure drop across the filter indicates difficulty of oil in getting through the filter. See Page 66.

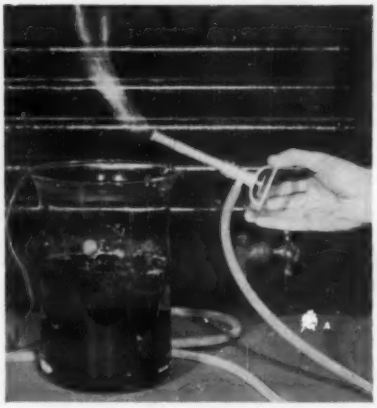
7. Correct answers are "a" and "c". Poor engine condition and improper fuels contaminate oil with carbon, acid, fuel oil, water, etc. See article on Page 46.

8. Correct answers are "b" and "c". Lower range of output speeds can be extended by controlling slip in coupling. See article on Page 50.

9. Correct answer is "b". There should be no smoke through entire rated speed and load range until overloading. See article on Page 58.

10. Correct answer is "a". Smaller currents jump through bearing gaps, etc. if ground clamp is not fastened properly. See article on Page 43.

Here's a Live Electric Motor Taking a Bath



In Safe NEW Oakite #116

What you see above is *not* a recommended method for cleaning electric motors! It does, however, demonstrate the extreme safety of Oakite Composition No. 116—the new solvent cleaner especially developed for safe-cleaning electrical equipment.

Oakite Composition No. 116 is safe—both to personnel and equipment—because it won't conduct dangerous electrical currents or become ignited by stray sparks. As demonstrated above, even open flames can't cause hazardous explosions.

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news of our industry

Diesel-Powered Dragline

Equipped with a 60-ft boom, 4½-cu yd bucket, and powered by a Detroit Diesel 6-110 engine, this new Bucyrus Erie dragline has been put to work on the Indiana East-West Toll Road. The job calls for moving 2½ million cu yd of fill within a period of 5 mo to help meet a 1956 completion date for the entire undertaking.

Trane Expands Facilities

Two additions totalling 90,800 sq ft are being added to the Trane Co.'s La Crosse, Wis. Plant 4, and a 30,000-sq ft addition is under construction at its Scranton, Pa. plant. These are scheduled for completion in the first half of 1956 and will bring the company's total production area to about 1 million sq ft.

Trucker Adds Diesel Units

To handle increased tonnages and additional services, Texas-Arizona Motor Freight Lines, Inc. has installed 30 more Kenworth trucks in its fleet. With 35-ft trailers, they are being operated primarily between Texas and California, hauling a wide commodity variety.

The new Kenworth 522s have 200-hp Cummins diesels, and Fuller Roadranger transmissions with 10 gear positions selected by single-gear shift lever. Wheel base is 189 in, and the measure from back of cab to centerline of rear axles is 98 in. Each truck has a 4-spring rear bogey for stability and to support the frame over a greater length at six points. Two 65-gal fuel tanks are carried.

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news of our industry

AERA Sets Convention Date

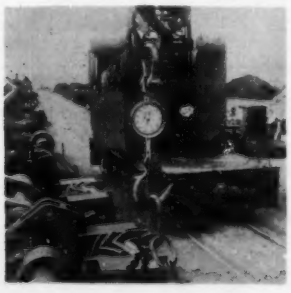
Providing an opportunity for racing fans among its membership to plan a combined trip, the Automotive Engine Rebuilders Assn. has arranged its convention schedule to follow the 500-mi race at Indianapolis next year. Dates are June 3-6 at Chicago's Hotel Sherman. "Keep Pace With Horse Power Race" is the theme.

The association, originated in 1922 for gathering and supplying information in the operation of engine and parts reconditioning shops, is believed to be the oldest automotive aftermarket group in the U. S. Active membership is open to wholesale distributors of automotive replacement parts, independent machine shop operators, and engine rebuilders whose principal business is selling engines at wholesale. Associate membership is open to manufacturers of automotive replacement parts, machine shop equipment, and related products.

Crane Overloading Guard

In spite of weight-radius charts posted in the cabs of cranes, much damage has occurred as the result of lifting excessive loads. Timken Roller Bearing Co. has virtually eliminated the danger through the use of a traction dynamometer.

The dynamometer, manufactured by W. C. Dillon & Co., Inc., is used as a scale, positioned directly in series with the load and between the lift hooks. It instantly indicates to the operator if the load is beyond the weight-radius capacity of the crane. The particular instrument used at Timken is of 0- to 50,000-lb capacity, although there are 12 other ranges available, going up to 100,000 lb.



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news of our industry

Van Norman Set to Expand

At a special meeting Nov. 30, stockholders of the Van Norman Co. will be asked to change its name and approve a new corporate structure. J. Y. Scott, president, stated that the changes were being sought to "reflect a wider diversification of interest and activities." New name desired is Van Norman Industries, Inc.

Diesels Air-Test Pipeline

American Louisiana Pipe Line Co. has begun air-testing approximately 1000-mi of 30-in gas pipeline which it is constructing from Detroit, Mich. to No. Tepetate, La. Equipment used consists of Gardner-Denver compressors powered by Caterpillar D337 diesels.

Each individual test unit is made up of three engines, two low-stage and one high-stage compressors. The low-stage compressors, developing 150 lb, feed directly into the suction of the high-stage compressor which develops 1000-lb pressure.

When a section of line is tested, it is brought up to 944-psi pressure, which is a 10% minimum above the maximum operating pressure. This pressure is checked by a dead weight tester and a recording chart made for a 24-hr test period. After a completed section of line has been tested and pressure check completed, the pressure is bled into the next section which is ready for test. The test sections vary from 5 to 15 mi in length. Results of the tests will be under keen observation of others in the pipeline industry.

Manila Rail Orders 40 Diesels

General Electric Co. will build 40 diesel-electric locomotives for the Manila Railways of the Philippine Islands, to be used in both road and switching service. Originally, it was stated, the road planned to order only eight, but a study of efficiency advantages of diesel-electrics over the line's present fleet of 82 steamers decided for the increase.

Thirty of the order will be 1200-hp road units, the other 10 will be 500-hp yard switchers. The road units will be further broken down into two types: 20 will be of universal design capable of both road and switching service and the other 10 will be streamlined for high-speed passenger service.

All road units will have two 3-axle trucks, six GE electric motors, and will be powered by Cooper-Bessemer V-8 engines. They will move at 60-mph maximum. The yard switchers will have two 2-axle trucks with all axles motorized. They will be equipped with four motors, powered by Caterpillar engines, and will be capable of 40 mph.

Scintilla Plant Expanded

New facilities are now under construction at the Sidney, N. Y. plant of the Scintilla Div., Bendix Aviation Corp. The $2 million program is being devoted to manufacturing as well as research expansion, covering 25,000 sq ft. Completion by the end of this year will give Scintilla a total of 550,000 sq ft of plant area.

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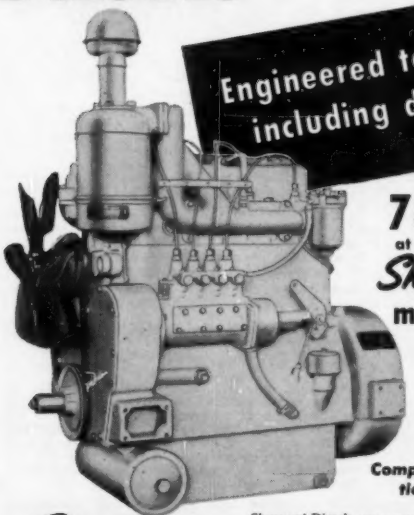

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new literature

Diesel-Hydraulic Locomotive

Model SH-2225 for industrial applications is given full treatment in Bulletin 2006 by Baldwin-Lima-Hamilton Corp. Included are component parts locations, tables of characteristics, tractive effort curve, and capability ratings.

Advice on Storage Battery

selection, charging, handling, maintenance, inspection, and testing, for starting diesel locomotives is offered by Gould-National Batteries, Inc., Trenton, N. J. All these are in a collection of articles, specifications, charts, record systems, manuals, and bulletins which make up the company's plus-performance plan.

Leak-Proof Hose Couplings

of the quick-seal type, are the subject of a revised catalog offered by Titeflex, Inc. Accessories are also included.

4300 US-Owned Inventions

are contained in a 7-vol "Patent Abstract Series", on sale by the Office of Technical Services, US Commerce Dept., Wash. 25, D. C. Instruction is also given on how to get more information and how to apply for use of the inventions under non-exclusive, royalty-free licenses.

Metal Parts Forming

principles, by expanding, shrinking, and roll forming, are explained in a booklet from Grotnes Machine Works.

172 Fire Safety Standards

as developed by the National Fire Protection Assn. have just been published in a revised 6-vol edition, a total of 4100 pages. Forty three changes have been made in the new volumes.

Correction Please!

The gremlins are back. In last month's story, "Run-In and Testing by Dynamometer", the torque formula was entirely inaccurate. As many readers have noted, it should read:

$$\frac{HP \times 5250}{rpm} = \text{Torque}$$

Well, it proves one thing. You people are certainly on the ball.

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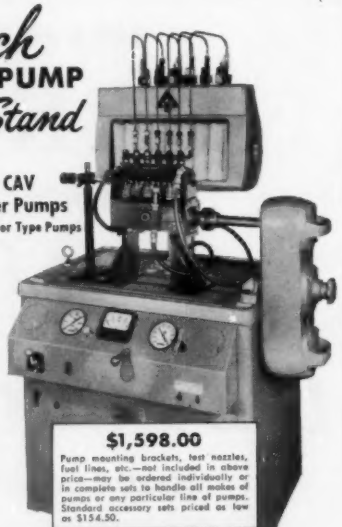

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State of New York } ss.
County of New York }

OF DIESEL POWER published monthly at Kutztown, Pennsylvania, for October 15, 1953.

1. The names and addresses of the publisher, asst. publisher and managing editor are:

Publisher, Renfrew G. Brighton, 192 Lexington Ave., New York 16, N. Y. Asst. Publisher, Wilbur W. Young, 192 Lexington Ave., New York 16, N. Y. Managing Editor, Brian P. Emerson, 192 Lexington Ave., New York 16, N. Y.

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Sworn to and subscribed before me this 2nd day of October, 1955.
ROSE VINE, Notary Public
State of New York No. 24-4102100
Qualified in Kings County
Certificates filed with Kings & N. Y. County Clerks
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organizational news

Appointed Vice President
of engineering at Rochester Mfg. Co., Robert W. Morgan will be in charge of design and research for the company's gauges and controls. He leaves Fedders-Quigan Corp.

R. W. Morgan

G. F. Habach

Full Administrative Control
of the engineering activities of Worthington Corp. has been given to George F. Habach, newly elected vice president of engineering. Harry A. Feldbush, former occupant of the post and with a record of 40 years of service in the company, will continue as a consultant.

I. M. Davies

R. C. Brown

Caterpillar Changes
involve the elevation of G. E. Burks, former engineering and research director, to a vice president; the appointment of J. M. Davies, former research director, as his assistant; and the establishment of R. C. Brown, former assistant director, as research director. C. R. Maxwell, most lately assistant research director, has also been named assistant to Mr. Burks.

West Coast Sales
at Resistoflex Corp. has been augmented by the addition of R. A. Paulbach to the management staff. He was formerly with Aeroquip.

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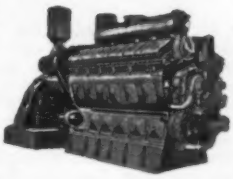

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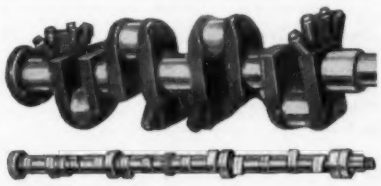

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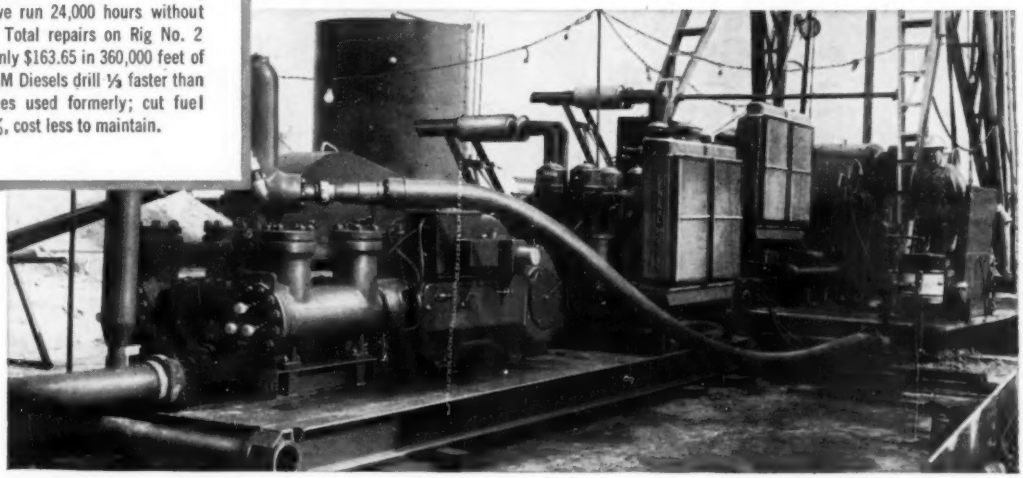

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